Los Angeles District

Remedial Investigation / Feasibility Study Work Plan

Former Mojave Gunnery Range "C"

Kern County, California

FUDS Project No. J09CA728101
Contract No. W912PL-06-D-0008
Task Order: 0001

Prepared for:
U.S. Army Corps of Engineers
Los Angeles District
915 Wilshire Blvd.
Los Angeles, CA 90017

FINAL

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Prepared by:
MARRS Services, Inc.
13360 Firestone Boulevard, Suite 2A
Santa Fe Springs, CA 90670

Rod Reeve, MARRS Quality Manager

APPENDICES

ACRONYMS

AEDA	Ammunition, Explosives, and Dangerous Articles
ANSI	American National Standard Institute
AP	Armor Piercing
APA	Aerial Photo Analysis
APP	Accident Prevention Plan
ARARs	Applicable or Relevant and Appropriate Requirements
ASCII	American Standard Code Information Interchange
ASR	Archives Search Report
ATF	Alcohol, Tobacco and Firearms
B&C	Brown and Caldwell
BATFE	Bureau of Alcohol, Tobacco, Firearms and Explosives
BGS	Below Ground Surface
BIP	Blow-In-Place
BLM	Bureau of Land Management
CAA	Clean Air Act
CADD	Computer Aided Design and Drafting
CDFG	California Department of Fish and Game
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESPL	U.S. Army Corps of Engineers, Los Angeles District
CFR	Code of Federal Regulations
COR	Contracting Office Representative
COTS	Commercial-off-the-shelf
CPR	Cardio Pulmonary Resuscitation
CSM	Conceptual Site Model
CWA	Clean Water Act
CWM	Chemical Warfare Material
DDESB	Department of Defense Safety Board
DERP	Defense Environmental Restoration Program
DGM	Digital Geophysical Mapping
DID	Data Item Description
DMM	Discarded Munitions Material

ACRONYMS (continued)

DoD	Department of Defense
DOT	Department of Transportation
DQO	Data Quality Objectives
DTSC	Department of Toxic Substances Control
EM	Electromagnetic
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ERRG	Engineering/Remediation Resources Group, Inc.
ESA	Endangered Species Act
ESRI	Environmental Systems Research Institute
EZ	Exclusion Zone
FAR	Federal Acquisition Regulation
FCR	Field Change Request
FFAR	Folding Fin Aircraft Rocket
FGDC	Federal Geographic Data
FS	Feasibility Study
FTP	File transfer Protocol
FUDS	Formerly Used Defense Sites
GIS	Geographic Information System
GPO	Geophysical Prove Out
GPS	Global Positioning System
HAZMAT	Hazardous Material
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEAT	High Explosive Anti-Tank
HE	High Explosives
HFD	Hazardous Fragmentation Distance
HTRW	Hazardous, Toxic or Radiological
HTTP	Hypertext Transfer Protocol
HTW	Hazardous Toxic Waste
HVAR	High Velocity Aircraft Rocket
IAW	In Accordance With
IDW	Investigative-Derived Wastes

ACRONYMS (continued)

INPR	Inventory Project Report
MARRS	MARRS Services Inc.
MBTA	Migratory Bird Treaty Act
MC	Munitions Constituent
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
MGFD	Munitions with the Greatest Fragmentation Distance
MGRC	Mojave Gunnery Range “C”
MIS	Management Information System
MPPEH	Material Potentially Presenting an Explosive Hazard
MRA	Munitions Response Area
MRS	Munitions Response Sites
MrSID	Multi-resolution Seamless Image Database
MSD	Minimum Separation Distance
NAD	North American Datum
NAV	North American Vertical Datum
NDAI	No DoD Action Indicated
NCR	Nonconformance Report
NEW	Net Explosive Weight
NGS	National Geodetic Survey
NHPA	National Historical Preservation Act
NWI	National Wetland Inventory
OB/OD	Open Burn/Open Detonation
ODC	Other Direct Costs
OE	Ordnance and Explosives
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment
PAO	Public Affairs Officer
PLS	Professional Land Surveyor
PM	Project Manager
PO	Purchase order
PPE	Personnel Protective Equipment

ACRONYMS (continued)

QC	Quality Control
QCP	Quality Control Plan
QD	Quantity Distance
QDN	Quality Deficiency Notices
QMS	Quality Management System
RA	Remedial Action
RCRA	Recourse Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RoE	Right–of-Entry
RTK	Real Time Kinetic
SAP	Sampling and Analysis Plan
SCAR	Sub Caliber Aerial Rocket
SDS	Spatial Data Standards
SDSFIE	Spatial Data Standards for Facilities, Infrastructure and Environment
SDTS	Spatial Data Transfer Standard
SDWA	State Drinking Water Act
SHPO	Advisory Council on Historical Preservation
SOP	Standard Operating Procedures
SOW	Scope of Work
SQL	Structured Query Language
SUXOS	Senior Unexploded Ordnance Supervisor
SVS	Surface Visual Surveys
TBC	To Be Considered
TBD	To be Determined
TCRA	Time-Critical Removal Action
TDEM	Time-Domain Electromagnetic
TEU	Technical Escort Unit
THPO	Tribal Historic Preservation Officer
TIF	Tagged Image File
TM	Technical Manual

ACRONYMS (continued)

TP	Technical Pamphlet
TPP	Technical Project Planning
TSDF	Treatment, Storage and Disposal Facility
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
UTM	Universal Transverse Mercator
UXO	Unexploded Ordnance
UXOQC	Unexploded Ordnance Quality Control
UXOSO	Unexploded Ordnance Safety Officer
WBS	Work Breakdown Structure

EXECUTIVE SUMMARY

This Remedial Investigation/Feasibility Study (RI/FS) Work Plan has been developed to provide guidance during the investigation of suspected MEC sites in the Mojave Gunnery Range "C" (MGRC) for the United States Army Corps of Engineers (USACE), Los Angeles District (CESPL). This work plan has been prepared in compliance with the Performance Work Statement (PWS) identified in Contract W912PL-06-D-0008 Task Order 0001. CESPL has Administrative Control and is managing all aspects of this project. A copy of the PWS dated 26 April 2006 has been provided as Appendix A of this work plan. The work required under this PWS is authorized under the Defense Environmental Restoration Program (DERP) for Formerly Used Defense Sites (FUDS) at the Mojave Gunnery Range "C" (MGRC), California City, California.

This RI/FS work plan outlines the investigation approach that will be used on all Munitions Response Areas (MRA)s within MGRC. Supporting documents such as site maps, points of contact, project forms and resumes are included in the appendices. Additionally, stand-alone plans and reports such as the Accident Prevention Plan, Munitions Constituents Sampling and Analysis Plan, Geophysical Prove-Out Plan and Geophysical Prove-Out Report are included as appendices to this work plan. For ease of use, this document is divided into chapters and appendices in accordance with USACE Data Item Description (DID) MR-001.

According to a review of the ASR, the MGRC was used for both targeting and firing activities during past United States Department of Defense (DoD) activities. This RI/FS work plan has been developed to investigate the identified Munitions Response Areas (MRA)s with a comprehensive sampling methodology consisting of visual, geophysical and intrusive investigations to characterize where Munitions and Explosives of Concern (MEC) activities occurred and define Munitions Response Sites (MRS)s within each MRA. The purpose of the RI/FS is to: identify and characterize potential remnant MEC and MC at MGRC; identify potential safety problems associated with the remnant MEC and MC; identify, evaluate, and recommend response alternatives for the remnant MEC and MC; and document the selected response alternatives for the areas addressed.

The overall approach to the MGRC RI/FS consists of using Surface Visual Surveys (SVS), combined with subsurface Digital Geophysical Mapping (DGM) to characterize the site. Key to this investigation is the development and maintenance of a "Right-of-Entry" (RoE) program to be used to request and manage the legal RoE for all properties within the MGRC. MARRS Services Inc. (MARRS) proposes a dynamic approach to the MGRC RI/FS based on the recommended minimum DGM sampling outlined in USACE Engineering Manual 1110-1-4009 combined with a RoE driven distribution to accomplish the investigation goals.

At the conclusion of the RI/FS, MARRS, in coordination with CESPL, will develop an RI/FS report that documents the results of the investigation, evaluates the findings of those activities in association with the proposed MEC alternatives, and recommends further remedial actions, a risk management process, or no DoD Actions Indicated (NDAI) for the areas investigated. The potential risk management or response alternatives identified through the RI/FS effort will be

evaluated based on effectiveness in remediating MEC and MC at the site, implementability, and overall cost. The selected alternatives will address MEC and MC contamination in a manner that meets acceptable levels of protection to human health, wildlife and the environment with respect to the intended future land use at the site. The format of the RI/FS report will be consistent with USACE guidance.

1.0 INTRODUCTION

1.1 PROJECT AUTHORIZATION

This work plan has been prepared in compliance with the Performance Work Statement (PWS) identified in Contract W912PL-06-D-0008 Task Order 0001 with the U.S. Army Corps of Engineers (USACE), L.A. District. U.S. Army Corps of Engineers, L.A. District has Administrative Control and is managing all aspects of this project. A copy of the PWS dated 26 April 2006 has been provided as Appendix A of this work plan. The work required under this PWS is authorized under the Defense Environmental Restoration Program (DERP) for Formerly Used Defense Sites (FUDS) at the Mojave Gunnery Range "C" (MGRC), California City, California. Definitions for the recent changes to the terminology used on FUDS sites are provided in the Table of Contents Section of this Work Plan.

1.2 PROJECT PURPOSE AND SCOPE

The Department of Defense (DoD) established the Military Munitions Response Program (MMRP) to investigate DoD sites suspected of containing munitions and explosives of concern (MEC) or munitions constituents (MC). Under the MMRP, the USACE is conducting environmental response activities at FUDS for the Army, the DOD's Executive branch for the FUDS program.

The purpose of this Remedial Investigation/Feasibility Study (RI/FS) is to collect and evaluate site information to allow the evaluation of Remedial Alternatives. This information is to be used to prepare and obtain stakeholder concurrence on a Decision Document.

This RI/FS work plan has been developed to investigate the identified Munitions Response Areas (MRA)s with a comprehensive sampling methodology consisting of visual, geophysical and intrusive investigations to characterize where Munitions and Explosives of Concern (MEC) activities occurred and define Munitions Response Sites (MRS)s within each MRA.

At the conclusion of the RI/FS, MARRS Services, in coordination with the U.S. Army Corps of Engineers, Los Angeles District (CESPL), will develop an RI/FS report that documents the results of the investigation, evaluate the findings of those activities in association with the proposed MEC alternatives, and recommend further remedial actions, a risk management process, or no DoD Actions Indicated (NDAI) for the areas investigated. The format of the RI/FS report will be consistent with U.S. Army Corps of Engineers (USACE) guidance.

All documents produced during the RI/FS process are available for public review at the MGRC information repository located at:

California City Branch Library
9507 California City Blvd.
California City, CA 93505
760-373-4757

Mojave Branch Library
16916 1/2 Highway 14, Space D2
Mojave, CA 93501

Additional information is available on the MGRC website located at:
http://www.mgrc-mmrp.org/

1.3 WORK PLAN ORGANIZATION

This RI/FS work plan is organized to provide the plan components or procedures and the site-specific characterization plan required to successfully complete the RI/FS activities. For ease of use, this document is divided into chapters and appendices in accordance with USACE Data Item Description (DID) MR-001:

Chapter 1 - Introduction. This chapter presents the project purpose and scope, site description and history, current and projected land use, previous investigations of the site and an initial summary of risk from Munitions and Explosives of Concern (MEC).

Chapter 2 - Technical Management Plan. This chapter presents the project objectives and outlines the project organization and lines of communication. This chapter outlines the project deliverables and reporting and presents the project schedule. Also included in this chapter are the procedures for billing, public relations support, and field operations/subcontractor management.

Chapter 3 – Field Investigation Plan. This chapter provides details on the site characterization goals, data quality objectives, data incorporated into the RI/FS report, MEC exposure analysis and the use of time critical removal actions during the project.

Chapter 4 – Quality Control Plan. This chapter provides details of the approach, methods, and operational procedures to be used to ensure quality throughout the duration of the project. This includes procedures for audits, corrective/preventive actions, data management, digital geophysical operations, anomaly acquisition and reacquisition, field operations, equipment calibration/maintenance requirements, pass/fail criteria for al quality audits, records generated , lessons learned and includes a process/training plan for all on-site personnel to ensure each employee meets qualification requirements as defined in the contract.

Chapter 5 – Explosive Management Plan. This chapter provides information for management of explosives for specific munitions responses in accordance with local, state and federal regulations, and contains a copy of the contractor's explosive license. It also contains the procedures for the acquisition, initial receipt, storage, transportation, inventory, and procedures in the event of loss, stolen or unauthorized use of explosives that are required to support the project.

Chapter 6 – Explosive Siting Plan. This chapter provides explosive safety criteria for the planning and siting of explosive operations for the project. It includes safe separation distances for each MRA, minimum separation distances for non-essential personnel during MEC operations, maximum fragmentation distances for use during intentional detonations, planned demolition areas, and the location of the explosive storage magazine.

Chapter 7 – Environmental Protection Plan. This chapter provides information on the approach, methods, and operational procedures to be employed to protect the natural environment during performance of all tasks related to the project. The plan is site specific and describes our procedures and methods during site activities to minimize pollution, protect and conserve natural resources, restore any damage, and control noise and dusts within reasonable limits. Procedures are also provided that detail methods to protect and/or mitigate the resource/sites of all known endangered/threatened species, wetlands, cultural/archeological/water resources, trees/shrubs that may be removed and existing waste disposal sites (if applicable).

Chapter 8 – Property Management Plan – Not required or included in this work plan.

Chapter 9 – Interim Holding Facility Siting Plan for RCWM Project Sites– Not required or included in this work plan.

Chapter 10 – Physical Security Plan for RCWM Project Sites– Not required or included in this work plan.

Chapter 11 – References - This chapter lists all guidance, regulations and policy under which the work will be done.

Appendix A – Project Performance Work Statement (PWS) – This appendix contains the PWS specifying the RI/FS.

Appendix B – Site Maps – This appendix contains oversized maps associated with this work plan. Maps that are letter-sized or smaller have been embedded as appropriate throughout this work plan.

Appendix C - Local Points of Contact - This appendix contains contact information for the project team to include regulators, stakeholders, vendors and law enforcement/fire control for use during the project. This appendix will be reviewed and updated as necessary throughout the project.

Appendix D - Accident Prevention Plan – This attachment, in conjunction with MARRS Injury, Illness, Prevention Plan establishes the safety and health policy program for the project. The plan describes the specific responsibilities of all project personnel to ensure the project is conducted with safety as the focus for all project activities.

Appendix E – Minimum Safe Distance (MSD) Calculation Sheets - This appendix is not used, as MSDs were generated using TP-16. MSD calculation sheets were not used. A table listing the MSDs is included in Chapter 6.

Appendix F - Project Forms - This appendix contains all forms references throughout this work plan for use on the project.

Appendix G - Sampling and Analysis Plan (SAP) - This appendix contains the SAP which describes procedures used for the planning results of munitions constituents sampling and analysis, quality assurance/quality control, laboratory qualification, data acquisition/data reporting, and chain-of-custody when environmental samples are required for the project.

Appendix H - Resumes - This appendix contains resumes of key personnel performing RI/FS activities for MGRC.

Appendix I – Conceptual Site Model (CSM) – This appendix contains the MGRC CSM. The CSM is a living document that is updated as new information is gained.

Appendix J – Demolition Standard Operating Procedure (SOP)

Appendix K – Geophysical Prove-out (GPO) Plan/Report - This appendix provides details on procedures used to evaluate Digital Geophysical Mapping (DGM) geophysical instruments, determine the standard response of selected instruments, evaluate instrument configurations, deployment techniques, and provide operator certification for instrument use. The GPO Letter Report outlines the results of the GPO and provides recommendations on the optimum equipment to perform the DGM investigation.

This RI/FS work plan outlines the investigation approach that will be used on all MRAs within MGRC. Supporting documents such as site maps, points of contact, project forms and resumes are included in the appendices. Additionally, stand-alone plans and reports such as the Accident Prevention Plan, Munitions Constituents Sampling and Analysis Plan, Geophysical Prove-Out Plan and Geophysical Prove-Out Report are included as appendices to this work plan.

- Under no circumstances will any change to this work plan be executed unless specifically approved by both the MARRS Project Manager (PM) and US Army Corps of Engineers, Los Angeles District (CESPL). CESPL will be responsible to notify State agencies and stakeholders of any significant changes.
- The PM will immediately notify CESPL and MARRS of the need to change this work

plan. The PM will provide a description of the circumstances and factors surrounding the need to change the plan using the Field Change Request Form included in Appendix F, recommend a course of action, and identify the impact the change will have on the project. Initial notifications will be made verbally within 48 hours and followed up within 7 days with the Field Change Request Form.

- If the circumstances requiring the change involve safety or quality, the PM will suspend all work affected by the unforeseen condition or activity until the cause is investigated and approved written procedures are in place.
- Approved changes will be briefed to site personnel prior to implementation

1.4 PROJECT LOCATION

The MGRC is located approximately four miles east of Mojave, California and overlaps the southwestern corner of California City, California as shown in Figure 1-1 MGRC Location Map. The MGRC encompasses approximately 20,656 acres in Kern County, CA.

1.5 SITE DESCRIPTION

The following sections include site background information, to include topography, climate, vegetation and geology gathered from State and Federal resources, as well as observations during multiple site visits of the area, previous MEC removal actions, and an initial summary of the MEC risk at MGRC.

1.5.1 Topography

The Mojave Gunnery Range "C" is located. on a level plain in what is considered to be the high basin of the Mojave Desert, sometimes referred to as the Antelope valley. Less that a mile to the west is the Tehachapi Mountain range, and the nearest named feature in that range is the Horned Toad Hills, which are northwest of the site. The land slopes gently upward from southeast to northwest, ranging in elevation from 2,700 ft to 2,800 ft above sea level. The increase in elevation, 100 ft over three miles is barely noticeable. Ground cover is limited with scattered grasses, sagebrush, Joshua trees and mesquite. A topographical map of the site is included as Figure 1-2.

1.5.2 Climate

MGRC situated in the High Desert Climatic region of Kern County. The climate is characterized by hot summers and cool winters. Winter temperatures in this region generally fall to a few degrees below freezing at night and reach about 60 degrees Fahrenheit during the day. During the winter months, light snowfall is common on the desert floor. The summers are characterized as hot and dry, with daytime temperatures exceeding 100 degrees Fahrenheit and nighttime temperatures that drop to about 60 degrees Fahrenheit. The region is surrounded

by several mountain ranges that greatly limit precipitation. The total annual rainfall in Mojave is about 6 inches. The wettest months are generally November through March during which more than half of the annual rainfall occurs. Rainfall is normally very low from June through August. Winds in the area are predominately from the northwest, with an average speed of 12 miles per hour (mph). However, the dry Santa Anna winds can gust up to 100 mph during the winter months. Another feature of the climate is the large number of clear days and the high percentage of sunshine. The four summer months (June through September) average 25 days per month with clear skies. The winter months (December through March) generally have the larger of cloudier days. Overall, 65% of the days throughout the year are either clear or partly cloudy, The air quality is influenced by mountain passes that help transport some air pollutants into the region. (DoD, 2002a).

1.5.3 Climate

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1.5.4 Vegetation

Vegetation present within MGRC is predominantly Creosote Sage Scrub, varying in height from 0 to 6 feet. Saltbush scrub occurs on the northwestern portion of the site varying in height from 0 to 2 feet. Joshua Tree Woodland occurs to the southeast of the site varying in height from 0 to 30 feet.

1.5.5 Site Geology

Three major rock types or geologic complexes characterize the geologic setting in the region: a basement complex of igneous rocks (rocks that have solidified from a molten state) and metamorphic rocks (rocks created when sediments undergo crystallization due to heat and

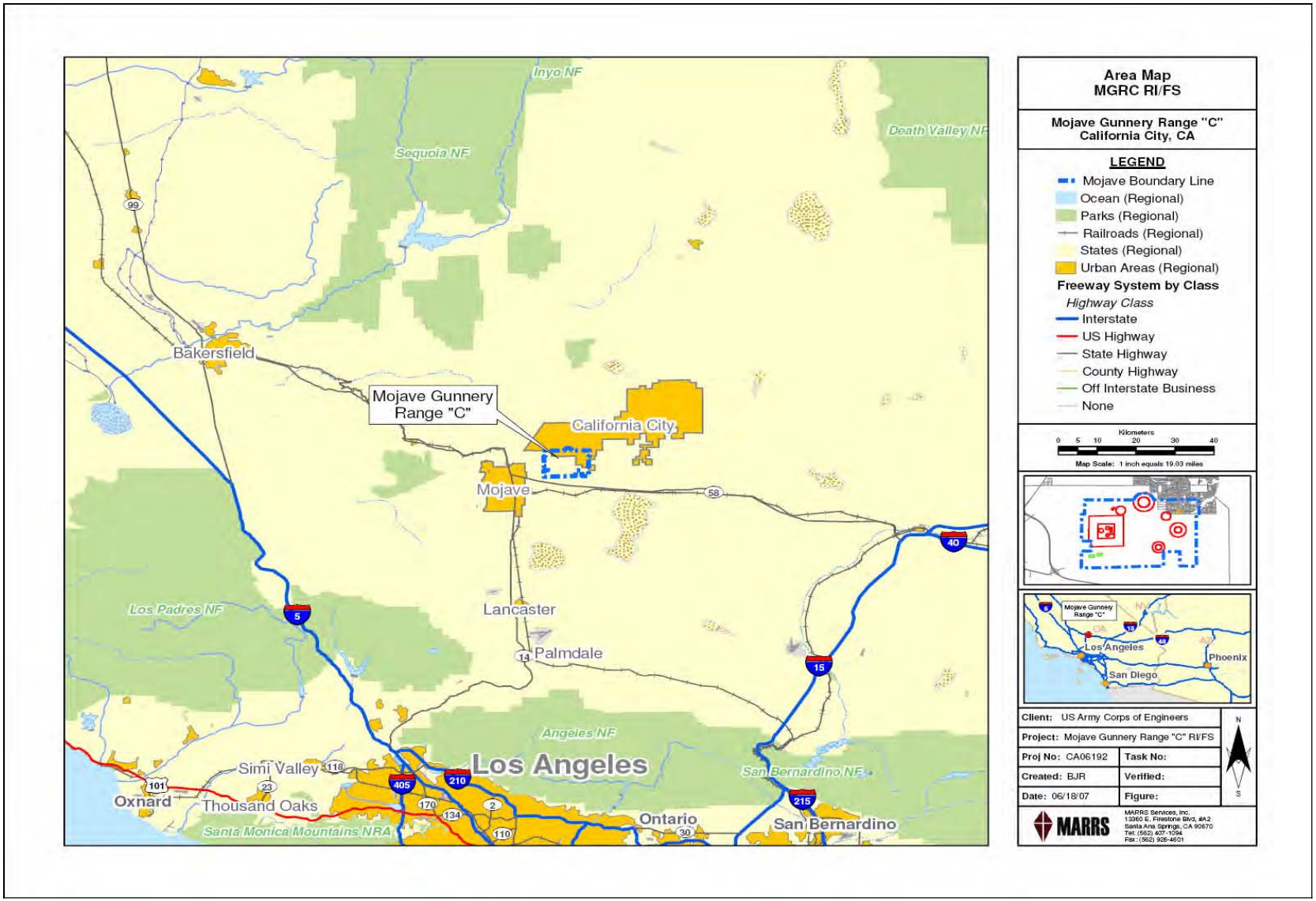


Figure 1-1. Mojave Gunnery Range "C" Location Map

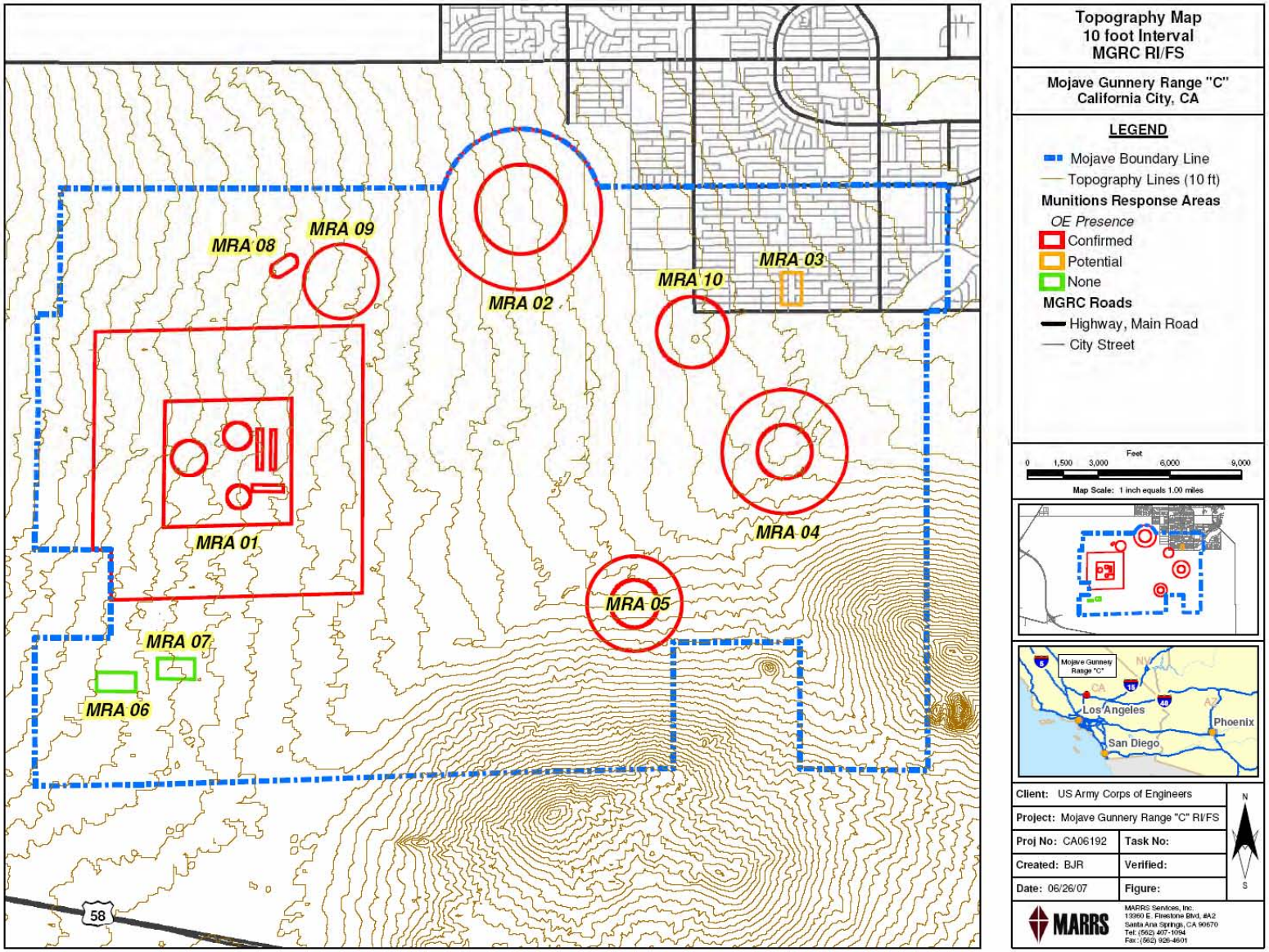


Figure 1-2. Mojave Gunnery Range "C" Topographical Map

1.5.6 Site Geology

Three major rock types or geologic complexes characterize the geologic setting in the region: a basement complex of igneous rocks (rocks that have solidified from a molten state) and metamorphic rocks (rocks created when sediments undergo crystallization due to heat and pressure); an intermediate complex of continental volcanic and sedimentary rocks; and valley fill deposits. The basement complex is of pre- Tertiary age and includes quartz monzonite, granite, gneiss, schist, and other igneous and metamorphic rocks. These rocks crop out in the highlands surrounding the playa areas, which are nearly level areas at the bottom of undrained desert basins, and occur beneath the unconsolidated deposits of the playa. The intermediate complex is of Tertiary age and includes a variety of sedimentary and volcanic rock types. (Dutcher and Worts, 1963, as cited in DoD, 2002b).

The soil formations in the region are comprised of thick, unconsolidated, coarse-textured alluvial sediments composed of gravel, sand and silt of granitic composition. Alluvial sediment is sediment that is deposited by flowing water, such as in a flood plain. The U.S. Department of Agriculture (USDA) classifies the soils as belonging to Cajon-Arizo and Rosamond types. Cajon soils are described as well- to excessively-drained sands and gravelly loamy (composed of a mixture of sand, clay, silt, and organic matter) sands developed on alluvial fans and alluvial plains. Rosamond soils are very deep, nearly level to moderately sloping, well-drained soils produced on flood plains and in basins (Kern County, 2003e)Soil limitations include high susceptibility of the sandy surface layers to soil blowing, shallow soil depth, low available water capacity and high potential for erosion due to slope and inadequate plant cover. However, these limitations are mostly controlled by low precipitation, low ground water and hot climate. (USDA Soil Conservation Service, 1982).

1.6 SITE HISTORY

On 19 August 1944 the Department of the Navy took possession of the land that would comprise MGRC. During World War II these lands were used as an air-to-ground training area with six reported stationary ground targets and one reported mobile target. Additionally, guided missiles were used on targets set up near the northern area of the range. After the war MGRC was used for testing and evaluation of pilot-less aircraft by both the Naval Air Station (NAS) Mojave and the Army. The Marines returned to Mojave in 1951 and closed the airfield during which time the Marine Corps terminated the leases for MGRC effective 31 December 1951.

1.7 HISTORY OF POTENTIAL ORDNANCE SITES

Ten MRAs have been identified for investigation during the MGRC RI/FS based on records reviews and site visits. Seven MRAs were initially developed, based on target information provided in the “Archive Search Report (ASR) findings for the Former Mojave Gunnery Range “C”, Kern County, California, Project Number J09CA728101, April 2002” Three additional MRAs were developed in accordance with the findings of the Draft Aerial Photo Analysis (APA) Site

Visit Report, former Mojave Gunnery Range “C” RI/FS, 19 March 2007. MRAs selected for investigation during the RI/FS are shown in Figure 1-3. The MRA’s are discussed below. The target designators identified in the USACE April 2002 ASR are provided in the parenthesis after each MRA number.

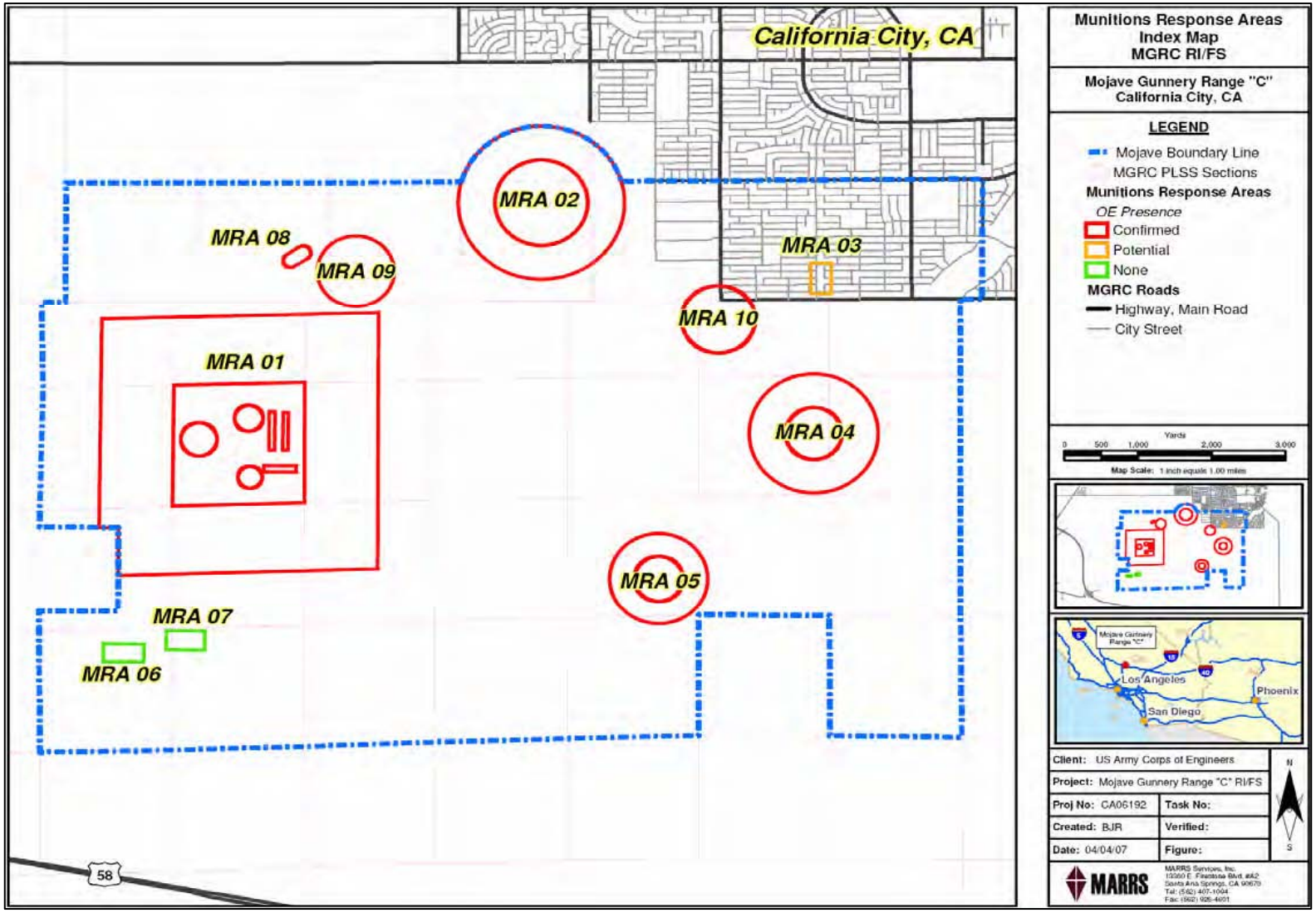


Figure 1-3. Mojave Gunnery Range "C" MRAs

1.7.1 MRA-01, (Areas A and B)

MRA-01 is a cluster of targets (Area A) and buffer area (Area B) encompassing 2,906 ac of land as indicated in ASR J09CA728101. The occurrence of this target and buffer area within private land creates a substantial potential for public exposure to MEC originating from bombing targets. MRA-01 has confirmed MEC presence. Munitions confirmed are the 20mm target practice (TP) projectiles, MK 15 100-lb practice bombs, AN-MK23 3-lb. practice bombs, and 2.75 High Explosive (HE) Folding Fin Aerial Rockets (FFAR), and 2.75 Inert FFAR have been confirmed on this MRA.

1.7.2 MRA-02, (Areas C and D)

MRA-02 is suspected to have been a convoy target (Area C) made up of tanks and vehicles due to the vehicle debris located in the area and a buffer area (Area D) encompassing 828 ac as identified in ASR J09CA728101. The occurrence of this target and buffer area within private land creates a substantial potential for public exposure to MEC originating from bombing targets. MRA-02 has confirmed MEC presence. Munitions confirmed are evidence of high explosive bombs and rockets.

1.7.3 MRA-03, (Area E)

MRA-03 is a former 20-mm aircraft strafing range encompassing 26 ac of land as indicated in ASR J09CA728101. MRA-03 has potential MEC presence. The occurrence of this target within private land creates a substantial potential for public exposure to MEC originating from strafing targets. Munitions confirmed are the 20 mm TP projectiles.

1.7.4 MRA-04, (Areas F and G)

MRA-04 is a former bombing target (Area F) and buffer area (Area G) encompassing 499 ac) of land as indicated in ASR J09CA728101. The occurrence of this target and buffer area on private land creates a substantial potential for public exposure to MEC originating from bombing targets. MRA-04 has confirmed MEC presence. Munitions confirmed are the AN-MK23 3-lb practice bombs, 20mm TP projectiles; and 50 cal small arms ammunition.

1.7.5 MRA-05, (Areas H and I)

MRA-05 is a former rocket target (Area H) and a buffer area (Area I); encompassing 289 ac of land as indicated in ASR J09CA728101. The occurrence of this target and buffer area within private land creates a substantial potential for public exposure to MEC originating from rocket targets. MRA-05 has confirmed MEC presence. Munitions confirmed are the 2.25-inch practice rockets (SCAR), 2.75-inch FFAR, and 20mm TP projectiles. An intact VS-50 anti-personnel landmine was also located but it is believed to have been a result of an inadvertent drop resulting from mistaken coordinates with an adjacent range.

1.7.6 MRA-06, (Area J)

MRA-06 is a suspected bombing target encompassing 31ac of land as indicated in ASR J09CA728101. No evidence of munitions usage was encountered during previous site visits. This MRA is considered to have no MEC presence.

1.7.7 MRA-07, (Area K)

MRA-07 is a suspected bombing target encompassing 31 ac of land as identified in ASR J09CA0728101. No evidence of munitions usage was encountered during previous site visits. This MRA is considered to have no MEC presence.

1.7.8 MRA-08, (APA areas 5 and 6)

APA Areas 5 and 6 were described in the APA Addendum as "Target With Concentric Rings Measuring 100 And 250 Feet In Diameter" The area the targets were reported to be approximately 2 acres each. During the visual inspection of the area, 2.25 rocket igniter leads and water/sand filled practice bomb debris were observed throughout the areas. After analysis of the data it was determined that APA Areas 5 and 6 may be an indication of a MRA. APA Areas 5 and 6 were combined due to their close proximity and recommended as additional an MRA with the addition of a 150 foot buffer around the 250 foot circles designated as MRA 08. with an area of approximately 16 acres. The occurrence of this target on private property creates a substantial potential for public exposure to MEC originating from this target.

1.7.9 MRA-09, (APA Area C)

APA Area C was described in the APA Addendum as "Cleared Areas" encompassing approximately 57 acres. During the visual inspection of the area, bomb fragments were observed throughout the entire area, along with .50 cal cartridge cases, links and projectiles, 2.25 rocket igniter leads and water/sand filled practice bomb debris. After analysis of the data it was determined that APA Area C may be an indication of a MRA. APA Area C was recommended as additional an MRA with 1500 foot radius from center of apparent target designated as MRA-09 with an area of approximately 163 acres. The occurrence of this target on private property creates a substantial potential for public exposure to MEC originating from this target.

1.7.10 MRA-10 (APA Areas E, E1, and E2)

Area E was described in the APA Addendum as "Hill 2443 In Section 31 T12n, R10w" encompassing approximately 39 acres. During the visual inspection, a large amount of bomb fragments and lighter fragments representative of a target were observed. Rock similar to that used to mark other MGRC targets, was observed on the hill and thought to have been used as a target marker.. After analysis of the data it was determined that APA Areas E/E1/E2 may be an

indication of a MRA. APA Areas E/E1/E2 was recommended as an additional MRA with 1500 foot radius from center of apparent target designated as MRA-10. with an area of approximately 163 acres. The occurrence of this target on private property creates a substantial potential for public exposure to MEC originating from this target.

1.8 CURRENT AND PROJECTED LAND USE

The former Mojave Gunnery Range "C" lands are owned by Kern County, the US government, and numerous private landowners with site acreage of 20,656. A small portion of the land is used for residential housing, Six Sections are currently in use as an automobile test track and the remainder is open and used primarily for off-road recreation by local residents and seasonal sheep grazing. The acreage for kern County and private land owners is difficult to track, as land ownership is fluid and changes on a weekly basis due to active real estate trading and purchase, as well as county or bank repossessions. The total number of individual parcels within MGRC is 5092.Some of these parcels are overlapped by more than one MRA. Table 1-1 displays the amount of MGRC parcels located within the MRAs and land use by MRA. A land use map, displaying the location and parcel use information is included in Appendix B.

Table 1-1. MGRC Land Use

	MRA 01	MRA 02	MRA 03	MRA 04	MRA 05	MRA 06	MRA 07	MRA 08	MRA 09	MRA 10
Government	100	212	103	149	0	0	0	0	2	43
Residential	0	0	0	0	0	0	0	0	0	1
Desert	26	12	0	10	2	1	1	2	8	0
TOTAL	18	0	0	1	1	0	7	0	0	3

1.9 PREVIOUS INVESTIGATION OF THE SITE

A DERP-FUDS Inventory Project Report (INPR) for MGRC was conducted by Science Applications International for the USACE LA District. The Findings and Determination of Eligibility (FDE), dated 10 January 2000, recommended a further ordnance and explosives investigation of this site due to its former military usage.

The "Archives Search Report (ASR) Findings for the Former Mojave Gunnery Range "C", Kern County, California, Project Number JO9CA728101, April 2002" presents the findings of the historical records search and site inspection for the presence of ordnance and explosives located at MGRC. Seven MRAs were initially developed, as a result of these actions and documented in the ASR. There were no other investigations of this site uncovered during the

Archive Report. The general and MGRC ASR contains information regarding munitions usage on target areas within the former MGRC. The MGRC ASR is located on the MGRC website located at http: http://www.mgrc-mmrp.org/ for download and review.

Three additional MRAs were developed in accordance with the findings of the Draft Aerial Photo Analysis Site Visit Report, Former Mojave Gunnery Range "C" RI/FS, 19 March 2007.

1.10 INITIAL SUMMARY OF MEC RISK

ASRs describing the Mojave Gunnery Range "C" indicate that a variety of MEC was used in "Dry-run" and "Live-Fire" exercises. No evidence of contamination by Chemical Warfare Material (CWM) or CWM components has been identified or reported. The Former MRGC ASR and previous reported encounters with MEC at the site indicate that a variety of MEC was used at the Former MGRC. The following list includes, but is not limited to, MEC items of concern that have been identified as likely to be present on the Former MGRC. Each of the MEC items listed poses a potential explosive hazard to the public and RI/FS personnel.

- Projectile, 20mm, High Explosive (HE)
- Bomb, 3-lb Practice, Zinc AN-MK5 with AN-MK4 Signal
- Bomb,3-lb Practice, Cast Iron, AN-MK23 with AN-MK4 Signal
- Bomb, 20-lb, Fragmentation, AN-M41
- Bomb, 25-lb Practice, Bomb Dummy Unit (BDU) 33/MK76, with Signal MK4
- Bomb, 56-lb Practice, MK89, with Signal MK4
- Bomb, 100-lb Practice MK15, with 1-lb Spotting Charge
- Bomb, 100-lb Practice MK38A2, with 3-lb Spotting Charge, M1A1
- Bomb, 100-lb General Purpose (GP) HE, M30A1
- Bomb, 250-lb GP HE, M57A1
- Bomb, 500-lb GP HE, AN-M64A1
- Bomb, 1000-lb GP HE, M65A1
- Rocket, 2.25-Inch Practice SCAR
- Rocket, 2.75-Inch Folding-Fin Aircraft Rocket (FFAR), Inert (Wax Filled)
- Rocket, 2.75-Inch FFAR, HE

2.0 TECHNICAL MANAGEMENT PLAN

2.1 PROJECT OBJECTIVES

The objectives of this RI/FS include a comprehensive sampling methodology involving surface visual, geophysical and intrusive investigations to collect data to identify areas that require Remedial Action (RA) or identify areas where No DoD Action is Indicated (NDAI).

2.2 PROJECT ORGANIZATION

MARRS is responsible for conducting the RI/FS in compliance with all applicable policies and guidelines. CESPL is responsible for providing contract oversight and quality assurance. MARRS will conduct the data collection necessary to formulate recommendations for presentation in the RI/FS Report. Prior to finalizing the report, MARRS will incorporate comments received from CESPL, CEHNC, regulatory agencies, stakeholders, and the public.

MARRS and their subcontractors, Kleinfelder, Engineering/Remediation Resources Group, Inc. (ERRG) and Brown and Caldwell (B&C), will provide the qualified personnel required to support all activities of the RI/FS. These will include, but not be limited to: UXO-qualified personnel to provide MEC safety; field supervision, data processing crews, biologists, archeologists, MEC intrusive investigation teams, geophysical investigation teams, soil sampling crews, and surveyors. The disposal of MEC found on the site during operations will be performed by a UXO-qualified team.

The following sections provide a brief description of the overall project team and responsibilities assumed by MARRS. Figure 2-1 presents a project organization chart that illustrates how specific individuals and/or organizations will interact with each other throughout the project.

2.2.1 U.S. Army Corps of Engineers, Los Angeles District

USACE has been tasked to evaluate and determine the necessity of MEC risk reduction actions for all FUDS. CESPL is the sponsor of the Former MGRC and has final approval over the RI/FS. The following consultants are under contract to CESPL during the RI/FS.

2.2.2 MARRS Services, Inc.

MARRS has been contracted to develop and perform the RI/FS for Former MGRC. The roles and responsibilities of MARRS management for this RI/FS are discussed in the following paragraphs. Prior to and during field investigations, MARRS will be responsible for the following:

- Development of this RI/FS work plan and assurance that all work performed is in compliance with this approved RI/FS Work Plan and Scope of Work.

- All aspects of the field investigations and evaluation, including Munitions Constituents (MC) soil sampling.

- Administration and management of all aspects of the RI/FS field investigation, along with analysis of the field data collected.

- Generation of a RI/FS report that will evaluate the potential MEC risk, evaluate remedial alternatives, and recommend remedial actions.

2.2.3 Kleinfelder

Kleinfelder has been subcontracted by MARRS to assist in the development of the RI/FS for Former MGRC. The roles and responsibilities of Kleinfelder for this RI/FS are discussed in the following paragraphs. Prior to and during field investigations, Kleinfelder will be responsible for the following:

- Development of Chapter 7 of this RI work plan and assurance that all work performed within their scope is in compliance with this approved RI/FS Work Plan and the project Performance Work Statement (PWS).

- Providing field biologist/archeologist monitors as necessary to support field operations to ensure minimal impact to sensitive flora and fauna and cultural resources.

2.2.4 Engineering/Remediation Resources Group, Inc.

Engineering/Remediation Resources Group, Inc. (ERRG) has been subcontracted by MARRS to assist in the development of the RI/FS for Former MGRC. The roles and responsibilities of ERRG for this RI/FS are discussed in the following paragraphs. Prior to and during field investigations, ERRG will be responsible for the following:

- Development of Chapters 5 and 6 of this RI work plan and assurance that all work performed within their scope is in compliance with this approved RI/FS Work Plan and Scope of Work.

- Assisting MARRS in field investigations and evaluation, including the siting of explosive magazines and the storage and disposal of MEC.

2.2.5 Brown and Caldwell

Brown and Caldwell (B&C) has been subcontracted by MARRS to assist in the development of the RI/FS for Former MGRC. The roles and responsibilities of B&C for this RI/FS are discussed in the following paragraphs. Prior to and during field investigations, B&C will be responsible for the following:

- Development of MGRC Public Information Plan and assurance that all work performed within their scope is in compliance with this approved RI/FS Work Plan and Scope of Work.

- Development of Public Meeting announcements and organization of Public Meetings associated with the project.

2.3 PROJECT PERSONNEL

It is MARRS policy to use a project-oriented approach to management for major contracts. MARRS' project management will consist of the Project Manager (PM), the Program Manager (PgM), the Contracts and/or Procurement Manager, Corporate Safety and Health Professional, and Quality Control (QC) Manager. Site project personnel include the Site Manager/Senior UXO Supervisor (SUXOS), the Unexploded Ordnance Quality Control Supervisor/Safety Officer (UXOQC/SO), the UXO Team Supervisor (UXOS), and the UXO technicians. Project administration consists of administrative staff, which will be responsible for all of the administrative requirements pertaining to the project.

Resumes of key project management and field personnel are presented in Appendix H. UXOS (Tech III), and UXO Technician (Tech I/II) will be approved by CESPL, under a separate letter, prior to mobilization for field activities. Authorization documentation for the UXO personnel will be available at the site for inspection or verification, as required.

2.3.1 Project Manager

The PM, who will be responsible for the day-to-day management of project activities, will interact with MARRS personnel assigned to the project through a variety of means, including meetings, electronic mail (e-mail), formal correspondence, and telephones. Staff meetings were conducted at the beginning of the project to organize a project team and familiarize team members with the project scope and staff assignments. The PM will hold weekly meetings, or as required, to monitor staff performance, resolve problems, and verify that contract requirements are being met to the quality expectations of CESPL.

The PM will be responsible for monitoring the project budget using MARRS' cost accounting system. Actual expenditures such as labor, other direct costs (ODC), and subcontractor costs are entered into MARRS' computer accounting system on a weekly basis. Printouts will be provided to the PM; these show actual expenditures with weekly and cumulative totals. The PM will review this information and interact with the project team to keep their performance on track. The PM will also inform the Program Manager on a weekly basis, or as required, of project performance, schedule, and budget.

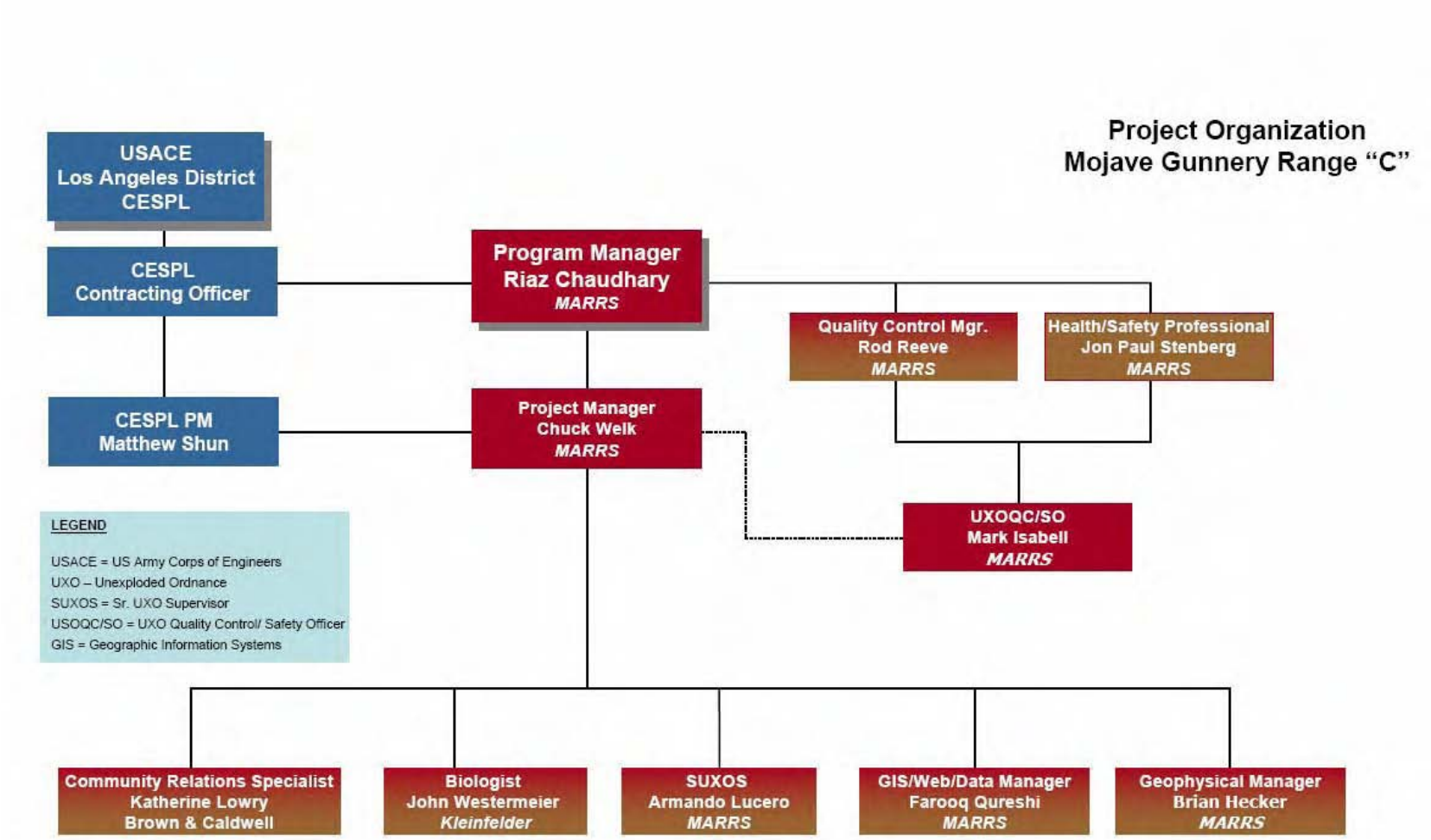


Figure 2-1. Mojave Gunnery Range "C" RI/FS Organizational Chart

2.3.2 Program Manager

The Program Manager will be responsible for monitoring the overall progress of the contract, reviewing monthly progress reports, and ensuring that MARRS' resources are available to the PM. The Program Manager will also maintain close communication with CESPL to assess client satisfaction with MARRS' performance on this Contract.

2.3.3 Contracts/Procurement Manager

The Contracts/Procurement Manager will also assist the PM and the Program Manager by coordinating expenditure documentation for the monthly progress reports, and CESPL contracts and invoicing.

2.3.4 Quality Control Manager

The QC Manager will be responsible for reviewing and updating the Quality Control Plan (QCP), as needed and verifying compliance with the QCP. Compliance will be verified through audits (using the Standard QC Report Form in Appendix F) of the project activities by the QC Manager, who has the authority to require corrective actions and stop work (work stoppage will be coordinated with CESPL), as needed, to ensure compliance with the QCP. Completed QC Report Forms will be forwarded to CESPL.

2.3.5 Corporate Health and Safety Professional

The Corporate Health and Safety Professional is responsible for review and coordination of the Accident Prevention Plan (APP) and addenda, as required. Other Health and Safety Professional duties include Program Administration, Safety Audits, determination of personal protective equipment (PPE) requirements, and any other responsibilities identified in the APP.

2.3.6 Senior UXO Supervisor (SUXOS)

The SUXOS meets all applicable requirements of Department of Defense Explosive Safety Board (DDESB) TP18, and will be approved for the project by CESPL. The SUXOS will ensure that field personnel conduct operations at the site in accordance with the work plan and in a systematic manner using proven operating methods and techniques. All activities will be conducted under the direction, supervision, and observation of the SUXOS (or a UXO Supervisor during the UXO escort activities). Additional responsibilities of the SUXOS include, but are not limited to:

- Coordinating all on-site field activities with the PM and CESPL, and other personnel at the site to preclude impacts to productivity and ensure compliance with the Work Plan and APP
- Implementing changes as directed by the PM

- Tracking equipment operation, with hours worked, idle, or down for repair
- Maintaining an up-to-date, informative, and complete daily project log describing work performed each day, including location, description, and worker(s); site conditions; visitors, or any other pertinent project occurrences.
- Reviewing deliverables/submittals with contract reference, by whom, and action taken
- Determining ingress/egress routes to work areas
- Ensuring that daily/weekly deliverables are developed and delivered on schedule
- Checking and accepting materials received at the site with statement as to acceptability, storage, and reference to contract requirements.
- Managing the on-site manpower and equipment necessary to safely conduct the tasks associated with the field investigation.
- Stopping work, as required, to maintain personnel and environmental health and safety
- Coordinating on-site field activities (e.g., geophysical mapping and intrusive investigations) to preclude impacts to productivity and ensure compliance with the APP.
- Ensure that site operations are conducted in accordance with all relevant safety and health specifications, regulations, and standards.
- Certifying Material Potentially Presenting an Explosive Hazard (MPPEH) and munitions/range debris as ready for turn-in or disposal
- Performing a final inspection of the munitions debris (MD) and certify it to be free of any explosive hazard.
- Authorizing initiation of demolition operations
- Authorizing the resumption of site operations upon completion of demolition and verification/clearance of residual hazards

2.3.7 UXO Quality Control/Safety Officer (UXOQC/SO)

The UXOQC/SO meets all applicable requirements of DDESB TP18, and will be approved for the project by CESPL. The UXOQC/SO is responsible for implementing and enforcing the QC Plan and implementing and enforcing the safety and health requirements listed in the APP. Additional responsibilities of the UXOQC/SO include, but are not limited to:

- Ensuring MEC/MPPEH/MD anomaly sources have been completely removed from all intrusive excavations
- Conducting quality control inspections of all MEC- and explosives-related operations
- Verifying appropriate personnel are being utilized during all field investigation activities

- Conducting examination of the quality of workmanship
- Maintaining all inspection and surveillance documentation (e.g., QC reports, equipment standardization results and equipment maintenance results, nonconformance and corrective action documents).
- Performing and documenting daily inspections/surveillances of job site activities. Appropriate technical assistance will be provided to perform the inspections/ surveillances, as necessary, for the specific field investigation activities being performed
- Verifying all required equipment calibration has been performed and that inspection and standardization results comply with contract requirements and the Work Plan
- Analyzing MEC and explosives operational risks, hazards, and safety requirements
- Conducting the UXO safety portion of any visitor orientation
- Conducting and documenting daily safety inspections and weekly safety audits
- Developing and implementing corrective action plans to eliminate or mitigate hazards
- Monitoring compliance with the safety measures contained in the APP and associated documents during disposal operations
- Ensuring the proper use of PPE in accordance with the requirements of the APP
- Establishing and ensuring compliance with site-specific safety requirements
- Investigating and documenting injuries, illnesses, accidents, incidents, and near misses
- Verifying that the area around the operating site is clear of all nonessential personnel and that other UXO Supervisors have been notified prior to the start of disposal activities
- Providing the UXO safety portion of training sessions or briefings
- Stopping work if health and/or safety jeopardized or compromised

2.3.8 Geophysical Manager

A geophysicist whose qualifications meet those specified in USACE requirements will perform the geophysical investigation. Geophysical field investigations will be under the direction of a MARRS Senior Geophysicist with at least 15 years of field experience in designing/conducting geophysical surveys, and with at least 5 years of specialized experience in the detection and mapping of subsurface MEC. Duties will include:

- Oversee and monitor the entire geophysical effort, including collection, data processing, and interpretation of the geophysical data.

- Overall responsibility for the design, implementation, and management of the geophysical investigations tasked in this work plan, and will be the project geophysicist of record.

- Will be present to verify the validity of the measurement methods, data consistency, and reproducibility.

- Monitor data collection, daily logs, and field maps, and compare MEC sampling (i.e., excavation) findings with mapped geophysical anomalies to identify any anomaly locations that require further exploration.

- Review results of daily quality control checks, and check raw and processed data for quality issues.

- Review anomaly lists and add or remove selections based on manual review of targets before submitting as dig lists.

2.3.9 Field Geophysicists

Geophysical field personnel will have documented training on the equipment to be used and experience appropriate to their assigned responsibilities.

2.3.10 GIS Manager

- The GIS manager will be responsible for the management and presentation of geophysical target and field investigation data. Specific duties include:

- Day-to-day management responsibilities of GIS projects, staff, and budget

- Coordinates project GIS needs with the Program Manager, Site Manager, Project Geophysicist, and other project staff as necessary.

- Coordinates regularly with the CESPL GIS Manager and other CESPL personnel as required.

- Oversees the Database Manager, and provides high-level oversight of the development of the database users, structure, and applications.

2.3.11 Unexploded Ordnance (UXO) Technician III

The UXO Technician III supervises a UXO team. This individual will be a graduate of the U.S.

Army Bomb Disposal School, Aberdeen Proving Ground, Maryland, U.S. Naval Explosive Ordnance Disposal (EOD) School, Indian Head, MD or the U.S. Naval School, Eglin AFB, Florida. This individual must be qualified to perform all the functions for the following positions: UXO Sweep Personnel, UXO Technician I, and UXO Escort. The UXO Technician III will have at least 8 years combined active duty military EOD and contractor UXO experience.

2.3.12 Unexploded Ordnance (UXO) Technician II

The UXO II will be a graduate of the U.S. Army Bomb Disposal School, Aberdeen Proving Grounds, Maryland, the U.S. Naval EOD School, Indian Head, Maryland or the U.S. Naval School, Eglin AFB, Florida. This individual must be qualified to perform all the functions for the following positions: UXO Sweep Personnel, UXO Technician I, and UXO Escort. The UXO Technician II may be a UXO Technician I with at least 5 years combined active duty military EOD and contractor UXO experience.

2.3.13 Unexploded Ordnance (UXO) Technician I

The UXO I will be a graduate of the EOD Assistants Course, Redstone Arsenal, AL, EOD Assistants Course, Eglin Air Force Base, Florida, or a DoD certified equivalent course. This individual must be qualified to assist fully qualified personnel (UXO Technician II and above).

2.4 PROJECT COMMUNICATION AND REPORTING

To ensure that the work is consistent with the objectives of the RI/FS, MARRS will use the following guidelines in managing all project activity, and in communicating and reporting project status:

- A single Work Breakdown Structure (WBS) has been established that forms the basis for defining and assigning all work under this contract. This WBS will be included in required reports and invoicing to CESPL.

- All work will be planned and budgeted to support a hierarchy of schedules based on key project events.

- Project work will not be performed until it has been properly planned and approved. In cases where immediate performance of work is required to support the contract schedule, respond to CESPL direction, or otherwise serve some critical purpose, the detailed planning and approval of the work will be agreed to by MARRS and CESPL.

- Cost and schedule status will be evaluated monthly to generate performance data and to provide integrated cost/schedule analysis.

- MARRS and subcontract personnel assigned to the project will have proven capabilities

within their area of technical expertise, will be available for the duration of the contract, and will have previous experience on similar types of investigations and field projects.

As part of contract management, MARRS will prepare and submit weekly field progress reports that describe the status of work that has been performed since the previous weekly report, work currently under way, and work anticipated to be conducted. The report will determine if current work is on schedule. If the work is not on schedule, MARRS will determine what actions need to be taken in order to get back on schedule. Reports will be posted on the MGRC website to ensure stakeholders are kept updated on the project progress.

MARRS will maintain a record of telephone conversations, e-mail, and written correspondence affecting the decisions relating to the performance of this contract. A summary of each telephone conversation and a copy of E-mail and written correspondence affecting the schedule or costs of the T.O. will be submitted to CESPL with the monthly progress report.

2.5 PROJECT DELIVERABLES

Table 2-1 provides a schedule of major deliverables anticipated for the RI/FS.

Table 2-1. Deliverable Schedule

Deliverable	Date of Completion
Draft RI/FS Work Plan	June 29, 2007
Draft Final RI/FS Work Plan	September 14, 2007
Final RI/FS Work Plan	November 2, 2007
RI/FS Field Investigation	February 14, 2008
Draft RI/FS Report	March 17, 2008
Draft Final RI/FS Report	April 29, 2008
Final RI/FS Report	June 12, 2008
Draft Proposed Plan	July 12, 2008
Draft Final Proposed Plan	September 8, 2008
Final Proposed Plan	December 12, 2008

Draft Decision Document	December 26, 2008
Draft Final Decision Document	January 23, 2009
Final Decision Document	March 8, 2009
Daily SUXOS/QC Activity Report	Submitted electronically to USACE Representative and CESPL PM NLT 1200 hrs the following workday
Weekly Progress Report (submitted during field work)	NLT close of business each Monday
Meeting Minutes	NLT 10 calendar days after meeting

RI/FS = remedial investigation/feasibility study

NLT = no later than

2.6 PROJECT SCHEDULE

Field Project Tracking (schedule) will be performed with MS Project software. A tentative project schedule for MGRC RI/FS activities is presented in Figure 2-2. As changes to the schedule occur, it will be updated and distributed to the CESPL PM, Technical Lead, and on-site QAs. Copies will also be attached to the weekly reports as they are updated.

2.7 PERIODIC REPORTING

Weekly field reports will be submitted when field activities are occurring and will contain the information required in DID MR-085.

2.8 COSTING AND BILLING

2.8.1 Scope

This section describes the procedures to be followed and defines the responsibilities of the PM to ensure efficient and effective cost tracking of project activities. The PM has access to MARRS' Management Information System (MIS), which contains project cost details that will be updated weekly. However, at times, the scope of field work necessitates more frequent tracking of costs. Accurate field cost tracking is also paramount to the process of invoicing CESPL.

2.8.2 Responsibilities

The PM, or a designated representative, will be responsible for tracking the costs associated

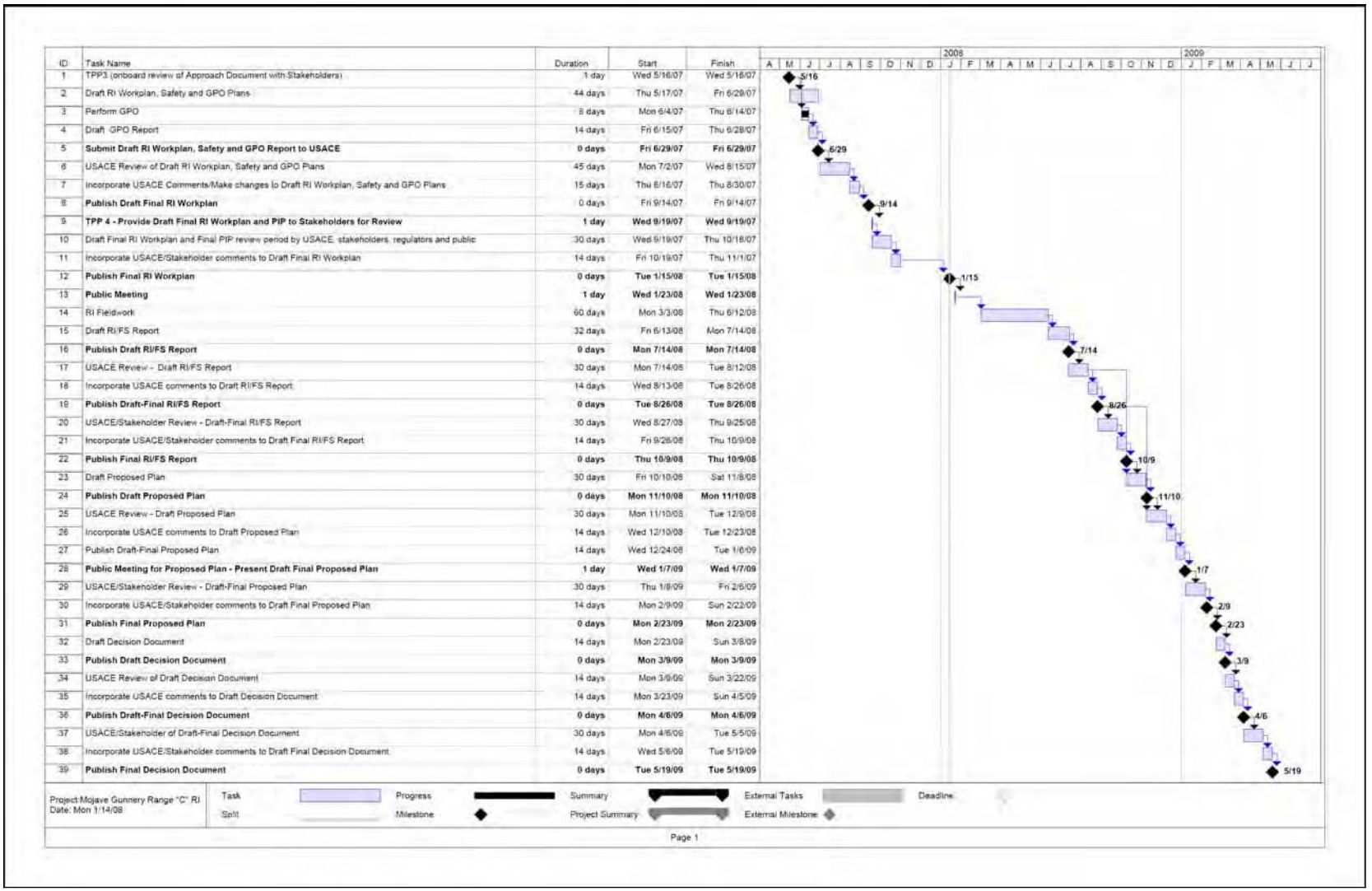
with project field activities. The PM will be responsible for defining the field cost tracking mechanisms that will be followed by MARRS' personnel. The PM will also be responsible for reviewing and approving subcontractor daily reports and accepting material and equipment shipped to the project site.

2.8.3 Field Cost Tracking

The effectiveness of the cost tracking approach described hereafter is predicated on thorough and realistic planning at the start of the project, during which a systematic mechanism for accumulating and organizing costs is adopted. Key to this process is the preparatory work performed by the PM to define the work phases that allow for effective cost management while minimizing complexity of the cost tracking process.

Field cost tracking will be key in progress reporting, in that at any time, the PM will know the status of costs incurred compared with the total project costs. The costs will be grouped into the following four categories:

- MARRS labor charges
- MARRS equipment charges
- MARRS material charges
- MARRS miscellaneous charges



ID	Task Name	Duration	Start	Finish
1	TPP3 (onboard review of Approach Document with Stakeholders)	1 day	Wed 5/16/07	Wed 5/16/07
2	Draft RI Workplan, Safety and GPO Plans	44 days	Thu 5/17/07	Fri 6/29/07
3	Perform GPO	8 days	Mon 6/4/07	Thu 6/14/07
4	Draft GPO Report	14 days	Fri 6/15/07	Thu 6/28/07
5	**Submit Draft RI Workplan, Safety and GPO Report to USACE**	**0 days**	**Fri 6/29/07**	**Fri 6/29/07**
6	USACE Review of Draft RI Workplan, Safety and GPO Plans	45 days	Mon 7/2/07	Wed 8/15/07
7	Incorporate USACE Comments/Make changes to Draft RI Workplan, Safety and GPO Plans	15 days	Thu 8/16/07	Thu 8/30/07
8	**Publish Draft Final RI Workplan**	0 days	Fri 9/14/07	Fri 9/14/07
9	**TPP 4 - Provide Draft Final RI Workplan and PIP to Stakeholders for Review**	**1 day**	**Wed 9/19/07**	**Wed 9/19/07**
10	Draft Final RI Workplan and Final PIP review period by USACE, stakeholders, regulators and public	30 days	Wed 9/19/07	Thu 10/18/07
11	Incorporate USACE/Stakeholder comments to Draft Final RI Workplan	14 days	Fri 10/19/07	Thu 11/1/07
12	**Publish Final RI Workplan**	**0 days**	**Tue 1/15/08**	**Tue 1/15/08**
13	**Public Meeting**	**1 day**	**Wed 1/23/08**	**Wed 1/23/08**
14	RI Fieldwork	90 days	Mon 3/3/08	Thu 6/12/08
15	Draft RI/FS Report	32 days	Fri 6/13/08	Mon 7/14/08
16	**Publish Draft RI/FS Report**	**0 days**	**Mon 7/14/08**	**Mon 7/14/08**
17	USACE Review – Draft RI/FS Report	30 days	Mon 7/14/08	Tue 8/12/08
18	Incorporate USACE comments to Draft RI/FS Report	14 days	Wed 8/13/08	Tue 8/26/08
19	**Publish Draft-Final RI/FS Report**	**0 days**	**Tue 8/26/08**	**Tue 8/26/08**
20	USACE/Stakeholder Review - Draft-Final RI/FS Report	30 days	Wed 8/27/08	Thu 9/25/08
21	Incorporate USACE/Stakeholder comments to Draft Final RI/FS Report	14 days	Fri 9/26/08	Thu 10/9/08
22	**Publish Final RI/FS Report**	**0 days**	**Thu 10/9/08**	**Thu 10/9/08**
23	Draft Proposed Plan	30 days	Fri 10/10/08	Sat 11/8/08
24	**Publish Draft Proposed Plan**	**0 days**	**Mon 11/10/08**	**Mon 11/10/08**
25	USACE Review - Draft Proposed Plan	30 days	Mon 11/10/08	Tue 12/9/08
26	Incorporate USACE comments to Draft Proposed Plan	14 days	Wed 12/10/08	Tue 12/23/08
27	Publish Draft-Final Proposed Plan	14 days	Wed 12/24/08	Tue 1/6/09
28	**Public Meeting for Proposed Plan - Present Draft Final Proposed Plan**	**1 day**	**Wed 1/7/09**	**Wed 1/7/09**
29	USACE/Stakeholder Review - Draft-Final Proposed Plan	30 days	Thu 1/8/09	Fri 2/6/09
30	Incorporate USACE/Stakeholder comments to Draft Final Proposed Plan	14 days	Mon 2/9/09	Sun 2/22/09
31	**Publish Final Proposed Plan**	**0 days**	**Mon 2/23/09**	**Mon 2/23/09**
32	Draft Decision Document	14 days	Mon 2/23/09	Sun 3/8/09
33	**Publish Draft Decision Document**	**0 days**	**Mon 3/9/09**	**Mon 3/9/09**
34	USACE Review of Draft Decision Document	14 days	Mon 3/9/09	Sun 3/22/09
35	Incorporate USACE comments to Draft Decision Document	14 days	Mon 3/23/09	Sun 4/5/09
36	**Publish Draft-Final Decision Document**	**0 days**	**Mon 4/6/09**	**Mon 4/6/09**
37	USACE/Stakeholder of Draft-Final Decision Document	30 days	Mon 4/6/09	Tue 5/5/09
38	Incorporate USACE/Stakeholder comments to Draft Final Decision Document	14 days	Wed 5/6/09	Tue 5/19/09
39	**Publish Final Decision Document**	**0 days**	**Tue 5/19/09**	**Tue 5/19/09**

Figure 2-2. MGRC Project Schedule

2.9 PROJECT PUBLIC RELATIONS SUPPORT

MARRS will participate in public meetings to discuss project progress and activities. These meetings are to be held in the California City area. The initial public meeting will be conducted on 08/15/07. The date(s) of follow-on public meetings will be scheduled as necessary in accordance with the project schedule. MARRS and its subcontractors will provide technical and logistical support for these meetings.

MARRS and its subcontractors have been advised by CESPL not to publicly disclose any data generated or reviewed under this contract or any subcontract, unless specifically authorized by the CESPL contracting officer. When approached by any person or entity requesting information about the MGRC RI/FS, project personnel will defer to the CESPL contracting officer or CESPL public affairs office (PAO) for a response. Reports and data generated under this contract will become the property of the government. Distribution to any other source by MARRS is prohibited unless authorized by the CESPL contracting officer.

2.10 SUBCONTRACTOR MANAGEMENT

Prior to subcontract work being performed, the MARRS Contract Administrator will negotiate and prepare a subcontract that will detail all necessary and appropriate terms and conditions, including the SOW. All subcontractors will be approved by the CESPL Contracting Office Representative (COR) Once the subcontract is executed, periodic reviews will be held to ensure that contractual requirements and milestones are met. These reviews will cover contractual progress, technical progress, and cost and schedule status.

In addition to reviews, the subcontractor(s) may be required to prepare weekly/monthly technical progress reports that identify one or more of the following: (1) progress and status of work; (2) significant accomplishments during the reporting period; (3) comparison of actual, technical, and schedule progress versus planned progress; (4) status of all long lead/critical delivery items; (5) analysis of significant problems; (6) current expenditures and status of work in terms of labor and dollars spent versus budget; and (7) a summary of specific plans for the next reporting period.

The Subcontract Administrator will be responsible for subcontract control and will be the point of contact to provide a direct and formal line of communication between MARRS and the subcontractor. Responsibilities of the Subcontract Administrator are as follows:

- Preparation and maintenance of a subcontract file, including all information generated during negotiations.
- Work authorization records and maintenance
- Coordination of all documents required for internal administration

- Subcontractor coordination, including the receipt and transmission of all correspondence
- Review of subcontractor invoices prior to payment
- Liaison with the PM regarding all matters affecting the subcontract
- Modification of subcontracts as required to reflect changes in technical direction during the term of the subcontract.
- Monitoring the subcontractor's work to assess progress

Data generated by the subcontractor(s) as part of subcontract deliverables will be reviewed by technical staff assigned to that function. In the field, the MARRS Site Manager (or designee) will review deliverables from the subcontractor prior to delivery to CESPL.

2.11 MANAGEMENT OF FIELD OPERATIONS

Specific responsibilities of the management team are discussed earlier in this chapter. All work will be performed in accordance with this RI/FS Work Plan and the MGRC PWS.

MARRS SM/SUXOS will be responsible for all field operations. To ensure that the project staff maintains focus on safety and project goals, the SM/SUXOS will hold daily operational staff meetings. The SM/SUXOS will manage technical UXO field operations to include surface visual surveys, intrusive investigations and disposal operations.

The Site Geophysicist will be responsible for the management of onsite geophysical field operations by being in direct and daily contact with the field teams and site management, and on site periodically throughout data collection. In addition responsibilities will also include data acquisition, management, processing and target reacquisition, delivery of daily logs, raw and field-processed data, and daily quality control documentation to the PM.

The GIS manager will be responsible for the management and presentation of geophysical target and field investigation data. Specific duties include the day-to-day management responsibilities of GIS projects, staff, and budget. The GIS Manager coordinates project GIS needs with the Program Manager, Site Manager, Project Geophysicist, and other project staff as necessary. The GIS Manager coordinates regularly with the CESPL GIS Manager and other CESPL personnel as required. The GIS Manager also oversees the Database Manager, and provides high-level oversight of the development of the database users, structure, and applications.

The safety of all personnel on the project site will be paramount during RI field operations. To ensure safety of the field crews, MARRS surface visual survey (SVS)/ digital geophysical mapping (DGM) teams have been designed to incorporate at least one UXO Technician II to allow them to operate without escort. A safety and work assignment briefing will be conducted

prior to the beginning of each day's field activities. The safety briefing will address any known hazards of concern for the particular area(s) to be investigated. Attendees and briefing substance will be recorded on the safety brief log (Appendix F).

SVS/DGM teams will maintain at least a 61 m (200 ft) separation distance from any other teams for safety while performing their tasks. The 61 m (200 ft) separation distance will be maintained from landowners and the public for general safety purposes. In the event that this distance is not possible, the UXOQC/SO and SM/SUXOS will be notified prior to the continuance of work

During the SVS/DGM, positions will be recorded for MEC, MD items, and other surface features such as craters, bunkers, and military equipment that will assist in demarcating target areas and analysis within the project GIS. MEC/UXO items discovered on the surface during the geophysical investigation will be reported to the SUXOS immediately and the MEC/UXO will be removed or disposed of in accordance with Chapter 6 Explosive Siting Plan.

Table 2-2, RI Field Teams outlines the personnel composition of surface survey, geophysical, reacquisition/dig, demolition, and QC teams. The number of teams may change as production/budget requirements fluctuate, to meet the RI field data collection objectives. Natural Resource/Cultural monitors may be required and will be designated to teams on an as-needed basis. The disposal team will be responsible for conducting MEC disposal/MPPEH/MD processing at the site. When they are not actively involved in disposal operations, this team will be used for all other MEC investigation tasks.

Table 2-2. RI Field Investigation Teams

Team	Surface Visual Survey/Digital Geophysical Mapping Team 3 Teams	Geophysical Target Reacquisition Team 3 Teams	Intrusive Investigation Team 3Teams	Disposal Team 1 Team	Quality Control/Safety 1 Team
Personnel (Per Team)	**1 UXO III** (Team Leader) **1 UXO II/Field** Geophysicist/Surveyor **1 (Tech 1/ Field** Geophysicist)	**1 UXO III** (Team Leader) **1 UXO II/Field** Geophysicist/Surveyor **1 (Tech 1/ Field** Geophysicist)	**1 UXO III** (Team Leader) **1 UXO II/Field** Geophysicist/Surveyor **1 (Tech 1/ Field** Geophysicist)	**1 UXO III** (Team Leader) **1 UXO II** (Team Member)	**1 UXOQC/SO**

Note 1 –Natural Resource monitors will be assigned to teams as required.

Note 2 – SVS/DGM will also conduct Reacquisition, Disposal and Dig Team duties.

Note 3 – Disposal Team members will function as SVS/DGM, Reacquisition/Investigation members when not performing disposal.

3.0 FIELD INVESTIGATION PLAN

This chapter provides details of the approach, methods, and operational procedures for RI/FS field investigation activities at MGRC, including:

- Land surveying
- Surface Visual Surveys (SVS) and Digital Geophysical Mapping (DGM)
- Geophysical data processing
- Reacquisition of geophysical targets
- Intrusive investigation of geophysical targets
- Data assimilation/analysis
- MC sampling and analysis
- Reporting

The composition of Management, field investigation teams is explained in Chapter 2.

3.1 OVERALL APPROACH TO THE RI/FS

The overall approach to the MGRC RI/FS consists of the use of surface visual surveys (SVS), combined with subsurface digital geophysical mapping (DGM) to characterize the site. MARRS Services Inc. (MARRS) proposes a dynamic approach to the MGRC RI/FS based on the recommended minimum DGM sampling outlined in USACE Engineering Manual 1110-1-4009 combined with a Right-of-Entry (RoE) driven distribution to accomplish the investigation. Within this approach, the following steps have or will be followed to investigate MGRC:

- Review of existing documents such as the Archives Search Report Findings for the Former Mojave Gunnery Range "C" and associated Aerial Photo Analysis (APA) Addendum combined with site visits to develop the MGRC Conceptual Site Model.
- Performance of a total-coverage surface visual survey of APA features outside of the ASR defined targets, to evaluate MEC/munitions debris (MD) presence, and define additional areas to identify MRA or dismiss area as not being an MEC area.
- Division of MGRC into management grids and sectors within the project Geographic Information System (GIS), to allow management and analysis of RI/FS data throughout the project.
- Development and maintenance of a "Right-of-Entry" program. The RoE program will be used to request the legal RoE for all properties within the MGRC. A layer within the project GIS will be used to track the RoE responses, access agreements, and visual representation of areas with access agreements to show where field teams can perform investigation actions.

- Perform a site-specific Geophysical Prove-out (GPO) to test proposed geophysical equipment and techniques for use during the RI/FS.
- Development of a RI/FS Work Plan using information gained during review of archive data, site visit, GPO and input/information resulting from the MGRC Technical Project Planning (TPP) meetings in accordance with project RoEs.
- Perform a surface visual survey/geophysical investigation of MRAs (ASR-defined targets and associated buffer areas) to evaluate the extent of MEC/MD concentration and allow investigation within the RI/FS.
- Report the findings in a RI/FS report with follow-on Proposed Plan and Decision Documents, as applicable.

3.1.1 RI/FS Goals

The purpose of the RI/FS is to:

- Identify and characterize potential remnant MEC and MC at MGRC
- Identify potential safety problems associated with the remnant MEC and MC
- Identify, evaluate, and recommend response alternatives for the remnant MEC and MC
- Document the selected response alternatives for the areas addressed.

The potential risk management or response alternatives identified through the RI/FS effort will be evaluated based on effectiveness in remediating MEC and MC at the site, implementability, and overall cost. The selected alternatives will address MEC and MC contamination in a manner that meets acceptable levels of protection to human health, wildlife and the environment with respect to the intended future land use at the site.

The RI/FS is a continuous process; necessary input includes consideration of the concerns of the stakeholders involved. The RI/FS will provide the background, approach, and evaluation process for determining the potential risk that MEC poses to the landowners and public at the MGRC site. The RI/FS will summarize field activities addressed in the work plan and outline recommendations for future actions based on the methodology described in this chapter. New information and further discoveries may affect the findings and recommendations of the RI/FS report. For the RI/FS process to be successful, close coordination and cooperation between the stakeholders, community, regulators, and technical support personnel must occur. In serving as a cornerstone for the long-term risk management effort at MGRC, the RI/FS report will identify and evaluate reasonable alternatives and provide recommendations for action, where appropriate. Figure 3-1 illustrates the RI/FS decision logic for MGRC.

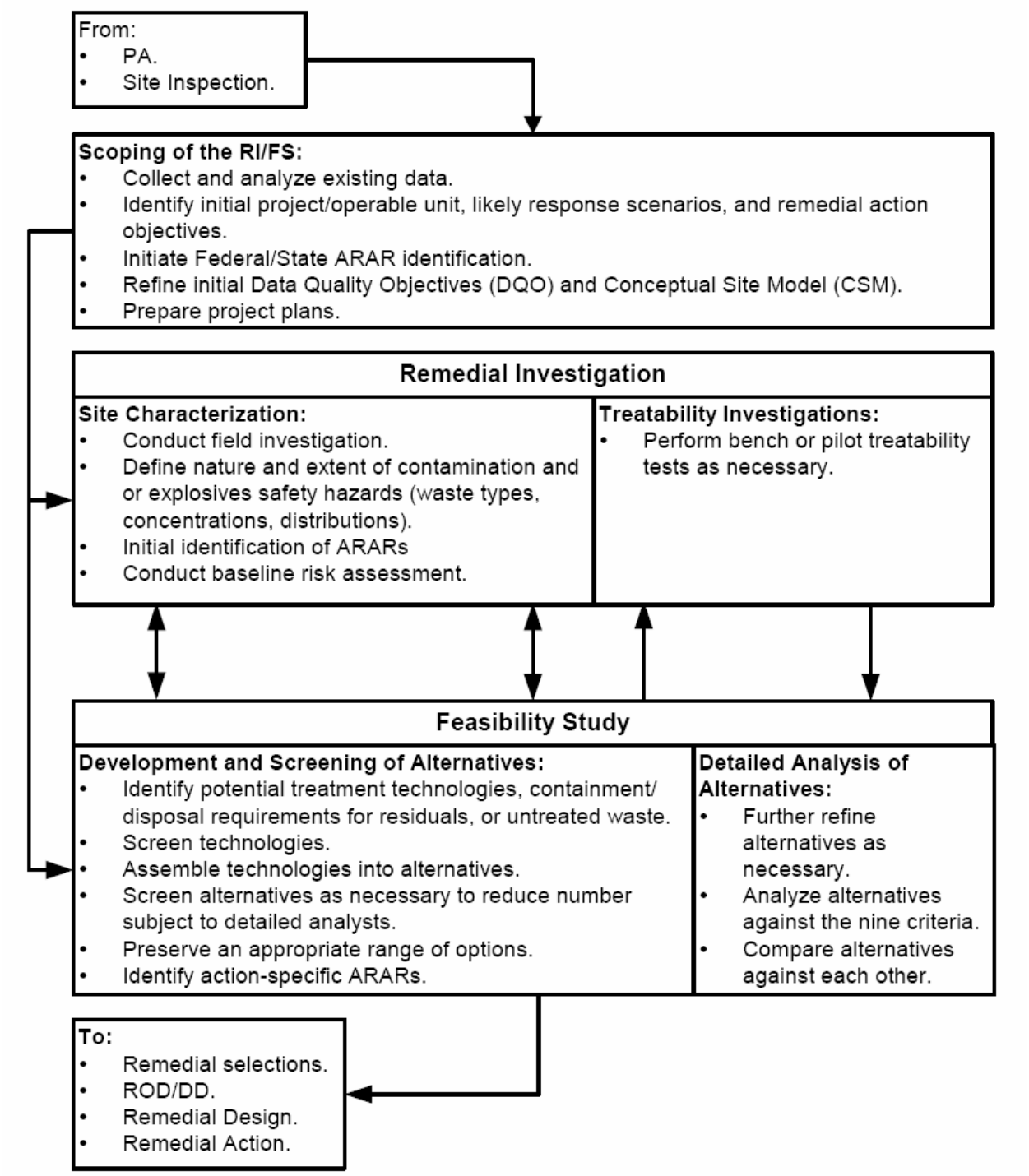


Figure 3-1. Decision Logic for the MGRC RI/FS

To achieve the objectives of this RI/FS, the site requires sufficient investigation for the presence of residual MEC and MC. Residual MEC will be estimated based on geophysical and intrusive data collected during RI investigation activities. Site MEC investigation goals include:

- Accurately locating and recording surface MEC
- Accurately recording geophysical anomalies
- Properly interpreting the geophysical data
- Properly documenting the intrusive findings.

Residual MC will be assessed through a biased sampling program for explosives or metals residue in site soil. Soil sampling activities will be conducted to determine if MC have been released when compared to Human Heath Preliminary Remediation Goals (PRGs) and project ambient conditions to confirm or deny a release of MC has occurred. In the event that an MC release is confirmed, future investigations may be conducted to assess possible impacts to human health, ecological receptors, and the environment associated with MC. MC investigation goals include:

- Locating undeveloped areas near historic targets
- Accurately defining MC metals concentrations in soil through a sampling and analysis program.

The RI/FS will be considered successfully completed when the site is characterized for both MEC and MC in environmental media, and appropriate potential response actions, if any, are recommended.

3.1.2 Data Quality Objectives (DQO)

Data Quality Objectives (DQOs) are qualitative and quantitative criteria used to guide sample collection and analysis activities. The DQOs for this RI/FS project are developed prior to conducting investigative activities to ensure that the data generated during the execution of the analytical program are of appropriate quality to support the anticipated end use of the data. DQOs seek to ensure that the right type, amount, and quality of data are collected to accomplish the objectives of the project.

The U.S. Environmental Protection Agency (USEPA) has a seven-step process for establishing DQOs as published in "Guidance for the Data Quality Objective Process" (Ref. USEPA, 2000). Each of the seven steps was applied in determining the DQOs for the RI/FS as described below.

Step 1: Problem Statement - The first step in developing DQOs is to define the problem that has initiated the study. For the purposes of this RI/FS, the problem statement is: “Do MEC items and MCs exist at the former Mojave Gunnery Range “C”?", and if so, "Do the remaining MEC

items and MCs pose a risk to current or future land users?"

Step 2: Identify the Decision - The second step in establishing DQOs is to identify the decision statement that the study will attempt to resolve. The potential for an explosive safety risk depends upon the presence of three elements: a source: (presence of MEC); a receptor or person; and an interaction between the source and receptor (such as picking up the item or disturbing the item by plowing). There is no risk if any one of these three elements is missing. Risk will be assessed by identifying and quantifying (where applicable), each of the three elements. Is MEC present? Are receptors present? Is there a possible interaction? MC concentrations detected in soil will be compared to preliminary remediation goals (PRGs) as a screening level indication of risk (discussed in Appendix G). The evaluations of site specific analytical results will be compared to the screening levels identified in Table 3-1 of the SAP Based on site-specific MEC and MC investigation data, response alternatives will be identified, evaluated, and selected for the protection of human health as well as ecological receptors at the site. If necessary, additional investigations will be recommended.

Step 3: Identify Inputs to the Decision - The primary data inputs for the RI/FS evaluation include the types, locations and depths of UXO identified at the site, MC concentrations detected in soil, and the anticipated land-use of the site. RI Field data inputs include:

- Results of SVS to locate surface features indicative of MEC usage (e.g. MEC/Material Potentially Presenting an Explosive Hazard (MPPEH)/MD, craters, surface scaring, target debris, pits, and trenches).
- Results of the DGM survey based on judgmental survey design to characterize areas indicative of MEC usage identified by the surface visual surveys:
    - Number, location, and magnitude of anomalies in locations representative of non-target conditions and target conditions.
    - Results of excavations/reacquisition for a representative subset of anomalies indicating whether MEC, MPPEH, or MD was present, the depth and orientation of discovered objects, and to the extent possible what type of MEC was found.
    - GPS measurements on survey control points, to confirm accuracy of the units to be employed in the field.
- Test results for DGM instruments on representative test plots.
- MEC chemical analysis at subset of areas with evidence of energetic remnants and metals residue. This will include areas which may not have energetic remnants such as small arms ammunition.
- Data obtained by others during the Edwards Air Force Base Target 71 project.

Step 4: Define the Study Boundaries - The geographical boundaries of MRA areas where review of the historical data, ASR, associated aerial photo analysis with verification site visit

indicated potential past training activity are shown in MGRC MRA Map included in Section 1.

Currently, ten (MRA)s have been identified for investigation during the MGRC RI/FS based on records reviews and site visits. The estimated area of the ten MRAs is 4,961 ac. Given that right-of-entry (RoE) permission from current landowners is required for sampling, less than 100% of the area of interest is likely to be accessible. Other anthropogenic constraints (such as fences, roads, buildings, and power lines) and non-anthropogenic constraints (such as cultural and environmentally sensitivity areas, terrain, and geologic materials) may also limit access throughout the MGRC. The MGRC MRA map in Section 1 shows the ASR-identified former target locations and the RI study boundary. The RI study boundaries are discussed in more detail in Section 3.2

Step 5: Develop a Decision Rule - The purpose of the decision rule is to define the parameter of interest, specify the action level, and integrate DQO outputs into a single statement that describes a logical basis for choosing among alternative response actions.

Munitions Constituents - If MCs are detected at concentrations greater than the PRGs or ecological screening levels established for the project (see Table 3-1 in the SAP), then additional Phase II sampling is required to define the nature and extent of MCs. Results of the geophysical investigation will be used to target the location of Phase II sampling towards areas with the highest density of MEC.

Munitions and Explosives of Concern - If MEC is present, receptors are present, and there is possible interaction, then evaluate appropriate response alternatives. Response alternatives will then be selected based on considerations of effectiveness, implementability, and cost.

Step 6: Specify Tolerable Limits on Decision Errors – The transect spacing, survey path width and line miles will combine to provide the recommended-minimum coverage for each of the specified MRA investigation areas. These coverage percentages at the MGRC range from 0.75% to 7.5% based on the overall dimensions of each MRA. The distribution of the transects required to meet the minimum-recommended acreage required by the USACE's Engineer Manual EM 1110-1-4009, Section 7.10 will be constrained to lands with approved RoE as presented and agreed upon at the Technical Project Planning meetings with stakeholders. Appropriate MC analytical quality levels are identified in detail in the Quality Assurance Project Plan (QAPP), of the MC Sampling and Analysis Plan (SAP) (Appendix G). The overall quality control program for this project is provided in Chapter 4.

Step 7: Optimize the Design for Obtaining Data - The purpose of this step is to identify a resource-effective data collection design for generating data that are expected to satisfy the DQOs. The RI/FS geophysical study design is optimized by:

Place geophysical transects within the MRAs identified for investigation during the MGRC RI/FS based on records reviews and site visits. The conceptual site model (CSM; Appendix I) indicates that most MEC, if present, would be within the target areas as opposed to the buffer

areas of each MRA.

Distribute the geophysical transects throughout each MRA adhering to EM 1110-1-4009 minimum-recommended coverage guidance and distribute transects to the greatest ability within RoE and Sensitive Species Constraints. Use judgmental transect placement in areas of MRA existing washes in search of errant materials that may have been moved by wind and water erosion.

Intrusively investigate all anomalies identified as geophysical targets through geophysical data processing and interpretation in accordance with the GPO Report.

3.1.3 Data Incorporation into the RI/FS Report

Reconnaissance, SVS, DGM, and intrusive investigation data will be migrated to the project MEC database. This database will be managed and updated as additional data are provided or generated. The MEC database will be designed such that specific queries, tables, and reports can be generated for analysis and presentation of the existing MEC hazards within each MRA. A database dictionary will be developed used for the acquisition of field data to ensure data integrity and reduce/eliminate data transcription errors. The RI/FS report will follow USACE format guidance and will be organized as follows:

- Executive Summary: Provides a summary of the report highlighting the objectives, RI results and recommended alternatives for MGRC.
- Chapter 1.0 - Introduction: Discusses the purpose and objective of the RI/FS
- Chapter 2.0 - Site Description: Provides the following:
    - Brief history of MGRC
    - Discussion of the natural features of MGRC (e.g., geology, soil, topography, sensitive ecology, archaeology).
    - General discussion of the current infrastructure and future land use within the project area.
    - Overview of MGRC
    - Summary of previous MEC investigations and removal actions within MGRC
    - Discussion of the applicable or relevant and appropriate requirements (ARARs) that apply to MGRC.
- Chapter 3.0 - RI Results: Discussion of the methodology and equipment chosen; results of previous technology evaluation; quality controls; quality assurance; geophysical investigation data collection results; the source, nature and extent of MEC; description of MEC hazards; and summary of MEC on site.
- Chapter 4.0 - Risk Evaluation: Includes the results of the qualitative risk assessment

using the MEC Hazard Analysis (HA) process to estimate the level of safety risk that exists as a result of the presence or potential presence of MEC.

- Chapter 5.0 - Institutional Analysis: Documents government agencies and private individuals that have jurisdiction over lands within the project area and assesses their capability and willingness to assert control that would protect the public at large from explosives hazards.
- Chapter 6.0 - Identification of RI/FS Objectives: Presents the process used to identify alternatives to be evaluated for the RI/FS.
- Chapter 7.0 - Identification and Analysis of Alternatives: Presents the alternatives considered in the RI/FS and a discussion of the evaluation criteria for each alternative.
- Chapter 8.0 - Recommended RI/FS Alternatives: Presents the recommendations for alternatives to manage risk (including a potential screening level ecological risk assessment), or conduct removals, or implement a RI.
- Chapter 9.0 - Recurring Review: Describes the recurring reviews performed by CESPL at MGRC.
- Chapter 10.0 - References: Provides an inventory of the reference material used in the preparation of the RI/FS.
- Appendix A - Performance Work Statement (PWS): MARRS PWS for the RI/FS
- Appendix B - Conceptual Site Model
- Appendix C - Geophysical Investigation Final Report
- Appendix D - Geophysical Investigation Results
- Appendix E - Environmental Sampling and Analysis Results
- Appendix F - Risk Management Plan
- Appendix G - Responsiveness Summary

Additional appendices will be provided, as necessary.

3.1.4 MEC/MC Exposure Analysis

Refer to Chapter 1 for the initial summary of MEC risk. All relevant data acquired during the RI fieldwork will be migrated to and analyzed within the MGRC GIS. Once the nature and extent of MEC/MC contamination at the site are characterized, the potential risk due to exposure to MEC/MC contamination will be assessed. The potential risk posed by MEC/MC contamination may be characterized by evaluating the ordnance, site characteristics, and human exposure pathways. The ordnance category includes the type of MEC identified, the level of sensitivity (i.e., the potential adverse health effects associated with exposure to the specified MEC/MC), the density of MEC in a specified area, and the depth of the MEC. If necessary, additional investigations or evaluations will be recommended.

3.1.5 Use of Time-Critical Removal Actions during the RI/FS Process

Time-Critical Removal Actions (TCRAs) are removal actions intended to address the imminent safety hazard posed by the presence of MEC, where cleanup or stabilization actions must be initiated within 6 months to reduce the risk to public health or the environment. Once the imminent threat at a site is addressed through the TCRA, additional work that is necessary is completed through the non-TCRA process. During the course of the RI/FS process, if an area is discovered that poses an imminent danger, CESPL will be notified for the purpose of reevaluating the area for a TCRA.

If an evaluation of the hazards warrants a TCRA, a Decision Document will be prepared and submitted. This document will contain a location and description of the site, a description of existing MEC hazards, current land use activities, and previous actions that have taken place to address the MEC hazard. The Decision Document will also include an endangerment determination with the following statement: "There is a significant possibility that an individual may encounter MEC hazards at this site, and that these hazards may cause injury or death to individuals who encounter the hazards if not addressed through the response action described in the Decision Document."

There are two types of TCRAs that may be considered during an MEC response action: a minimum-scope TCRA and an expanded scope TCRA. During a minimum-scope TCRA, the minimum resources necessary to address the imminent threat should be allocated. This could include, but is not limited to, removal of surface items, fencing the site in, and posting signs warning of the MEC hazard. An expanded-scope TCRA may be selected if it is deemed as cost effective to address full cleanup requirements in order to avoid future remobilization costs.

3.1.6 Follow-on Activities

Upon completion of the RI/FS and associated reports, follow-on activities may include:

- Implementation of Risk Management processes
- Implementation of Remedial Actions
- Implementation of the recurring review processes

3.2 IDENTIFICATION OF AREAS OF CONCERN

3.2.1 Munitions Response Areas (MRA)s

In order to facilitate a systematic and prioritized investigation, MGRC has been divided into management units identified as MRAs. These MRAs have been selected based on the result of the Archive Search Reports (ASRs). Consideration was given, when feasible, to the types of activities that occurred during DoD ownership in those areas. However, assignment of RI study areas by MEC type within each MRA was not feasible due to the insufficient data provided in the

historical records.

Currently, ten (MRA)s have been identified for investigation during the MGRC RI/FS based on records reviews and site visits. Seven MRAs were initially developed, based on target information provided in the "Archive Search Report findings for the Former Mojave Gunnery Range "C", Kern County, California, Project Number J09CA728101, April 2002". Three additional MRAs were developed in accordance with the findings of the Draft Aerial Photo Analysis Site Visit Report, former Mojave Gunnery Range "C" RI/FS, 19 March 2007. Additional MGRC history may be found in Chapter 1.

Based on historical records, MEC is not anticipated outside the MRAs, however, if MEC is identified outside an MRA, that area may be considered for inclusion in the RI as a MRA. A map and descriptions of each MRA is provided in Chapter 1.

Prioritization for conducting the RI will be focused on those MRAs that have historical ranges or targets within or overlapping them with special consideration given to biological resource, cultural resource, and Native American resource concerns and areas where RoEs were granted.

3.3 REMEDIAL INVESTIGATION TASKS

3.3.1 LOCATION SURVEYS AND MAPPING

The Location Surveys and Mapping Plan describe the methods, equipment, and accuracy for conducting location surveys and mapping of MEC sites. All work will be performed in accordance with USACE DID MR-005-07 guidelines.

3.3.1.1 General

A professional land surveyor (PLS) licensed in the State of California (working under direct contract to MARRS), will be retained for the setting of control monuments. These monuments will be located to provide the best coverage of the study area with respect to using these monuments as control points for the geophysical survey and MC sampling. Monument locations will be determined by the land survey subcontractor and approved by MARRS. Equipment used in positional surveying activities on the project will include Real Time Kinematics (RTK) GPS base station and rover(s), mapping grade GPS rovers, and survey total station. In most cases, survey equipment to be used will be RTK GPS or Wide Area Augmentation System (WAAS) capable hand-held GPS for surface visual surveys; use of other survey equipment and methods will be coordinated with CESPL. Transect locations will be entered into a GIS database. A tabulated list of monuments, corners, starting, ending, turning points or any pertinent survey data will be submitted in UTM coordinates in a Microsoft Excel spreadsheet (version 98 or higher) following completion of work. In addition, the location of MEC and munitions debris items recovered during RI activities will be recorded in UTM coordinates to the nearest 1-foot.

3.3.1.2 MEC Safety Provision

During all initial fieldwork and all intrusive activities, a UXO Technician will accompany the survey crew. The UXO Technician will conduct visual surveys for surface munitions prior to the survey crew entering a suspected area, and a magnetometer survey of each intrusive activity site to ensure the site is anomaly free prior to the surveying crew setting monuments or driving stakes. This individual will not be assigned additional survey tasks which would interfere with the MEC safety aspects of area clearance for driving stakes, iron pins, monumentation, or other survey control, which will penetrate the surface in a potentially MEC-contaminated area.

3.3.1.3 Accuracy

All survey control points will be tied to established monuments with horizontal and vertical control of "Class I, Third Order" (accuracy of 0.01 feet) or better IAW USACE DID MR-005-01. Horizontal control for the site shall be based on North American Datum 83 (NAD83) using the Universal Transverse Mercator (UTM) Zone 11S, Meters. Vertical control, if available and required will also be based on either the Metric system and referenced to the North American Vertical Datum 88 (NAVD88).

Where existing monuments are inadequate for the requirements of this work plan, new control points will be emplaced and will be of a permanent nature for recoverability during future phases of work within the same project. All control points will be iron or steel pins, concrete monuments, or other permanent construction method. The Northing and Easting (Y, X) for all control points, grid corners, transect points, and any boundaries or closures will be presented in the RI/FS Report

3.3.1.4 Plotting/Mapping

The location, identification, coordinates, and elevations of all the control points recovered and/or established at the site will be plotted on reproducible media for plan metric or topographic maps at the scale specified in the task order. Each control point will be identified on the map by its name and number and the final adjusted coordinates and elevations.

Each map will include a grid north, a true north, and a magnetic north arrow with the differences between them in degrees, minutes, and seconds shown. Grid lines or tic marks at systematic intervals with their grid values will be shown on the edges of the map. A legend showing the standard symbols used for the mapping and a map index showing the site in relationship to all other sites within the boundary lines of the project area will be shown.

The coordinates for the transect markers or sampling grid corners will be shown to the closest 0.3 m (1 ft). The locations of individual recovered MEC items will be surveyed using GPS instrumentation to obtain a horizontal accuracy of ± 0.3 m (1 ft) and plotted and identified on the map.

3.3.2 Digital Data

An overall planimetric design file will be created and digitized into an Environmental Systems Research Institute (ESRI) ArcView file at an elevation of zero. Cut sheet plots and views into the project data will be created by referencing the planimetric and contour files from additional ArcView work files. All associated cell, reference, or attachment files will be attached and provided with the digital data set along with all other supporting files or data. All production and work files will be fully documented into a concise data manual. This manual will include all specific information required for an outsider to be able to recreate all products and determine the location, names, structures, and association of the data such as layer description, weights, colors, symbology, referencing of files, etc. This manual will be included as an ASCII file titled READ.ME that will be included with all distributed digital data.

All data will conform to the Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE). All data will be submitted electronically on IBM-compatible PC optical media (CD-ROM).

3.3.3 Items and Data

3.3.3.1 MEC Items

Spatial location of MEC items encountered will be surveyed with GPS technology to mark the location of the MEC item. All associated GPS and dictionary data will be submitted in a specified ESRI format and/or MEC database to CESPL.

3.3.3.2 Other Items as Required

Throughout the course of the project, it is anticipated that the location of other items or features (e.g., roads, firebreaks, fences, power lines) will need to be determined. The location of these items will be acquired with RTK/GPS technology where possible, and with standard surveying procedures where terrain and or vegetation preclude such acquisition. Selection of the appropriate survey method for other items will be coordinated with CESPL.

The data items to be delivered and the specific timeframe for delivery will be as specified in EM 1110-1-4009, Chapter 8. Deliverables will be submitted in electronic format and will include:

- Original copies of all field books, layout sheets, computation sheets, abstracts and computer printouts.

- Tabulated listing of all project control markers established and/or used in support of the MEC response showing adjusted horizontal and vertical positional values in meters.

- Tabulated listing of all UXO/MEC recovered and any specific anomalies not completely investigated.

- Completed description cards
- Unique items created and/or used to create the end products and the narrative and description required by the SOW.
- Required location, project, and grid maps

3.4 SURFACE PREPARATION

The clearing of vegetation will not be performed during this project. Surface metal removal entails the visual inspection of each transect for metal ordnance-related items and scrap. This activity helps ensure that only subsurface anomalies are investigated during subsequent geophysical survey operations. The same crew performing the DGM will also perform the surface metal removal. If possible, large surface items that can not be moved will be avoided, and the transect survey lines moved away from/directed around the items.

3.5 GEOPHYSICAL PROVE-OUT PLAN AND REPORT

The geophysical methods and equipment to be employed during the RI/FS were assessed during the GPO performed in June 2007, The GPO Work Plan and Draft Report are included in Appendix I. The existing GPO plot will be used during the RI for training of geophysical field staff members and function testing of geophysical equipment to be employed during the RI. These activities will be conducted at the previously established GPO plot located on the Hyundai North American Test Facility.

3.6 GEOPHYSICAL INVESTIGATION PLAN

This section provides details regarding the approach, methods, and operational procedures that will be employed while performing RI-related geophysical investigations for the MGRC. This section was developed in accordance with DID MR-005-05 and is based on the findings of the GPO. All work regarding the geophysical investigation during this RI will be conducted in accordance with this Geophysical Investigation Plan, the PWS, the APP, and applicable USACE DIDs.

3.6.1 Site Description

The MGRC is located approximately 4-miles east of Mojave, California and encompasses the southwest corner of California City, California, as shown in Figure 1. The MGRC comprised approximately 21,750 acres of which 644 acres (Area M) is still retained by the Department of the Navy and 450 acres (Area L) is used for private air-to-ground ordnance testing. This total includes 293 acres of investigation area that have been added to Area C/D that were not accounted for by the ASR. Ten munition response areas (MRA)s have been identified for investigation during the MGRC RI/FS based on records reviews and site visits. Seven MRAs were initially developed, based on target information provided in the “Archives Search Report

Findings for the Former Mojave Gunnery Range "C", Kern County, California, Project Number JO9CA728101, April 2002". Three additional MRAs were developed in accordance with the findings of the Draft Aerial Photo Analysis Site Visit Report, Former Mojave Gunnery Range "C" RI/FS, 19 March 2007. The ten MGRC MRAs that comprise approximately 4,961 ac and are Kern County. Additional detail is provided in Section 1.4 and Section 3.2.

3.6.1.1 Geophysical DQO

The objective of the geophysical investigation is to accurately locate and record the locations of geophysical anomalies (potential MEC). The geophysical investigation areas and identified anomalies will be mapped for subsequent evaluation (including intrusive investigations of anomalies where geophysical signal strength and amplitude suggest the potential of MEC). Refer to the GPO Report (Appendix I) for a discussion of Geophysical DQOs.

3.6.1.2 Specific Areas to be Investigated

Specific areas to be investigated during the RI include MGRC MRAs 01 through 10 as described in Chapter 1. Table 3-1 displays the specific coverage and proposed transect spacing for each MRA.

The proposed locations for the SVS/DGM transect lines are shown in Figures 3.2 – 3.11. The placement of the data collection transects is intended to permit probability statements to be made regarding MEC characteristics across the site. As the exact areas available for RoE access and sensitive habitat are currently unknown, the transects will be adjusted in the field to accommodate these issues. Currently, MRAs 09 and 10 lack of sufficient RoE access for an adequate investigation. RoE access will be migrated to the GIS and analyzed following the receipt of the next batch of RoEs, and maps will be updated

During selection of areas to be investigated, several measures have been and will be implemented to mitigate, eliminate, and avoid disturbance and impacts to threatened and endangered species habitat. The RI/FS Team biologist will be present during startup for personnel training for identification of threatened and endangered species and habitat. As safety allows, RI/FS Team biological monitor(s) will walk with the investigation crew to provide avoidance and first-hand identification and instruction of what areas to avoid.

Table 3-1. Specific Area Coverage and Transect Spacing

MRA	01	02	03	04	05	06	07	08	09	10
MRA Area (ac)	2905.6	827.1	25.8	498.2	288.4	30.9	30.6	15.5	176.8	162.3
Coverage %	.75	1.5	7.5	1.5	1.5	7.5	7.5	7.5	1.5	1.5
RoE Available Area (ac)	2095.2	409.6	4.8	164.7	288.4	30.9	30.6	15.5	TBD	TBD
Transect Spacing (ft)	315.4	108.3	8.2	72.3	218.7	43.7	43.7	43.7	TBD	TBD
Transect Length (line-miles)	54.8	31.2	4.9	18.8	10.9	5.8	5.7	2.9	6.7	6.1

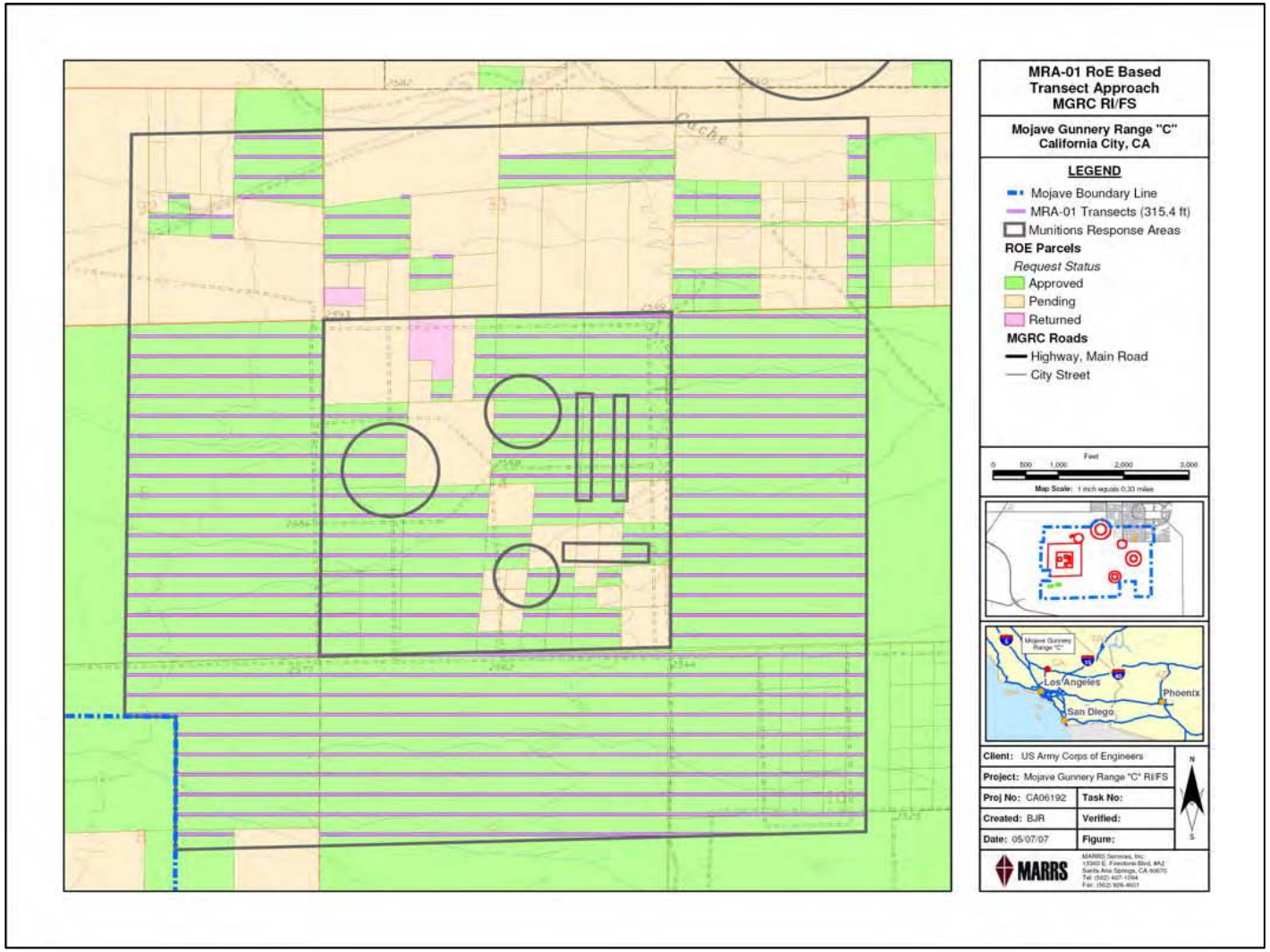


Figure 3-2. MRA-01 Conceptual Transect Coverage Map

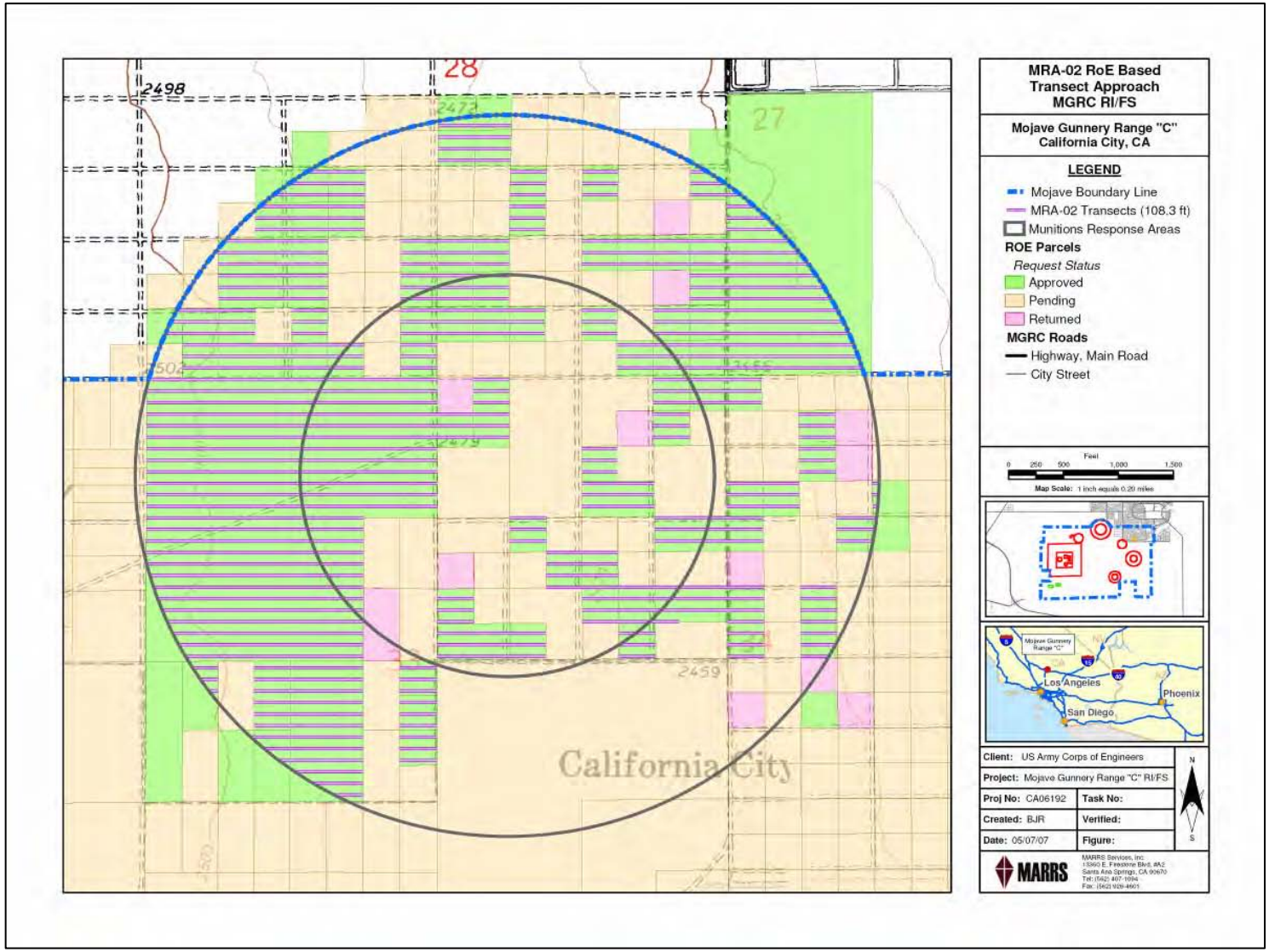


Figure 3-3. MRA-02 Conceptual Transect Coverage Map

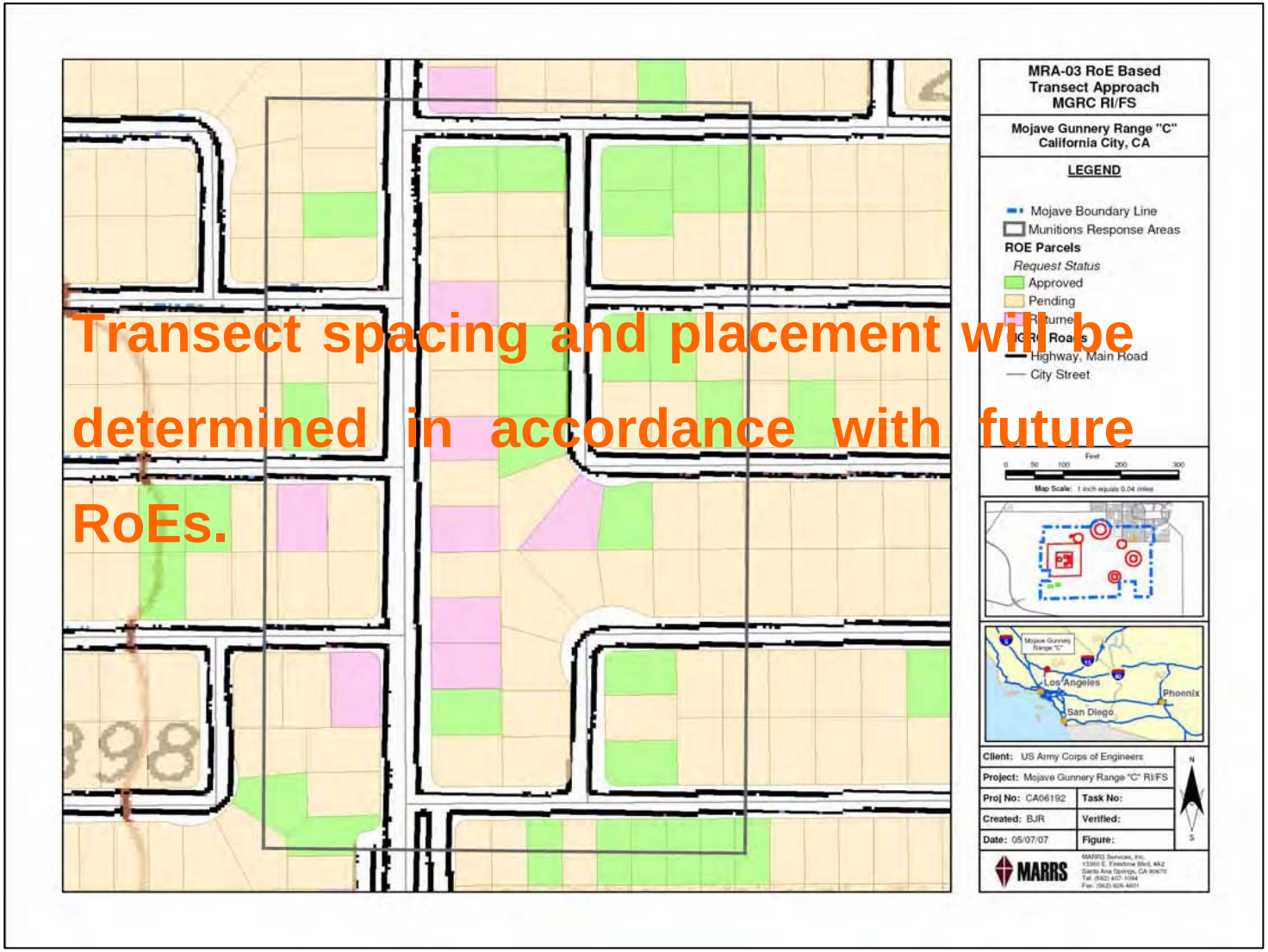


Figure 3-4. MRA-03 Conceptual Transect Coverage Map

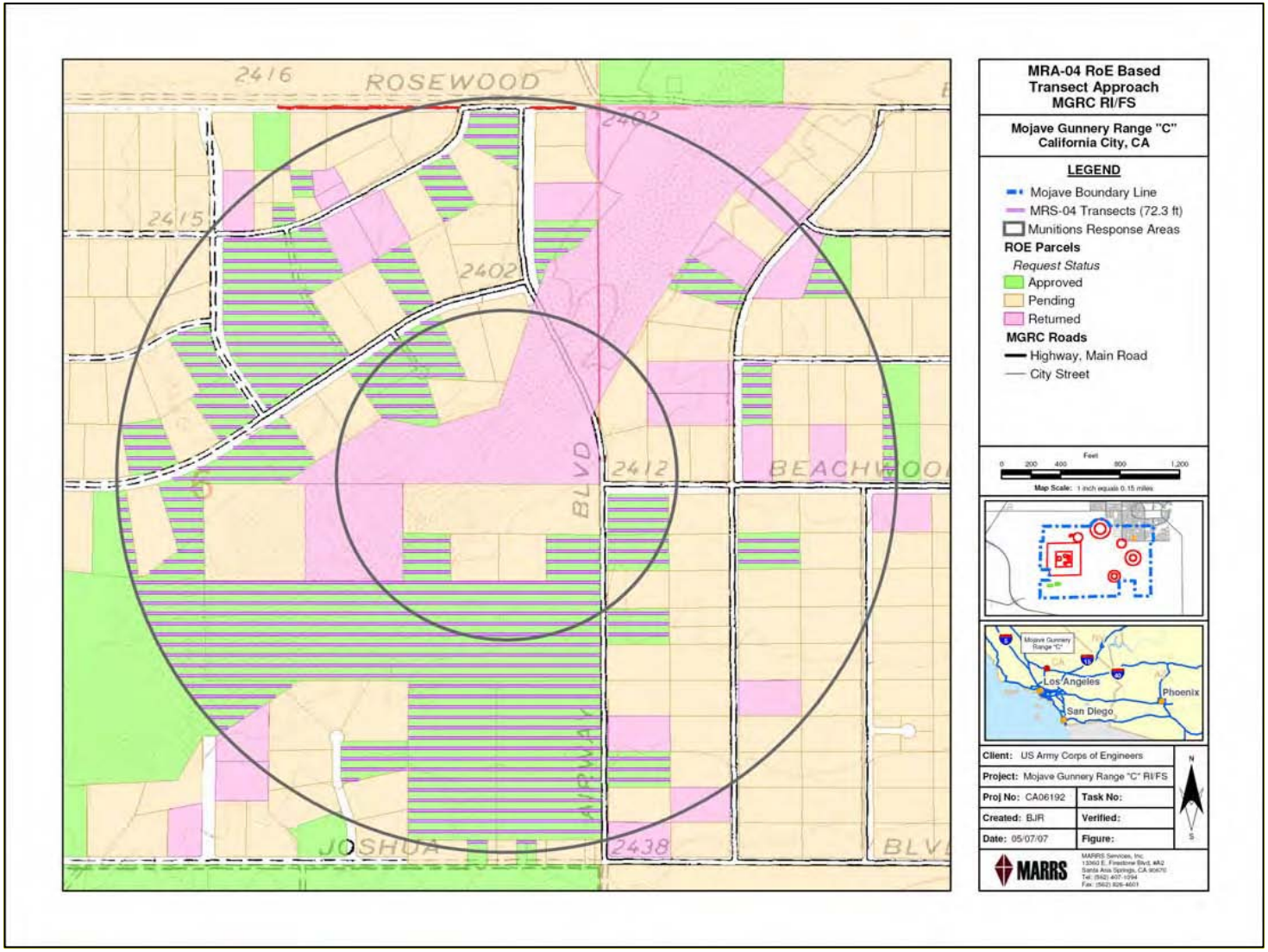


Figure 3-5. MRA-04 Conceptual Transect Coverage Map

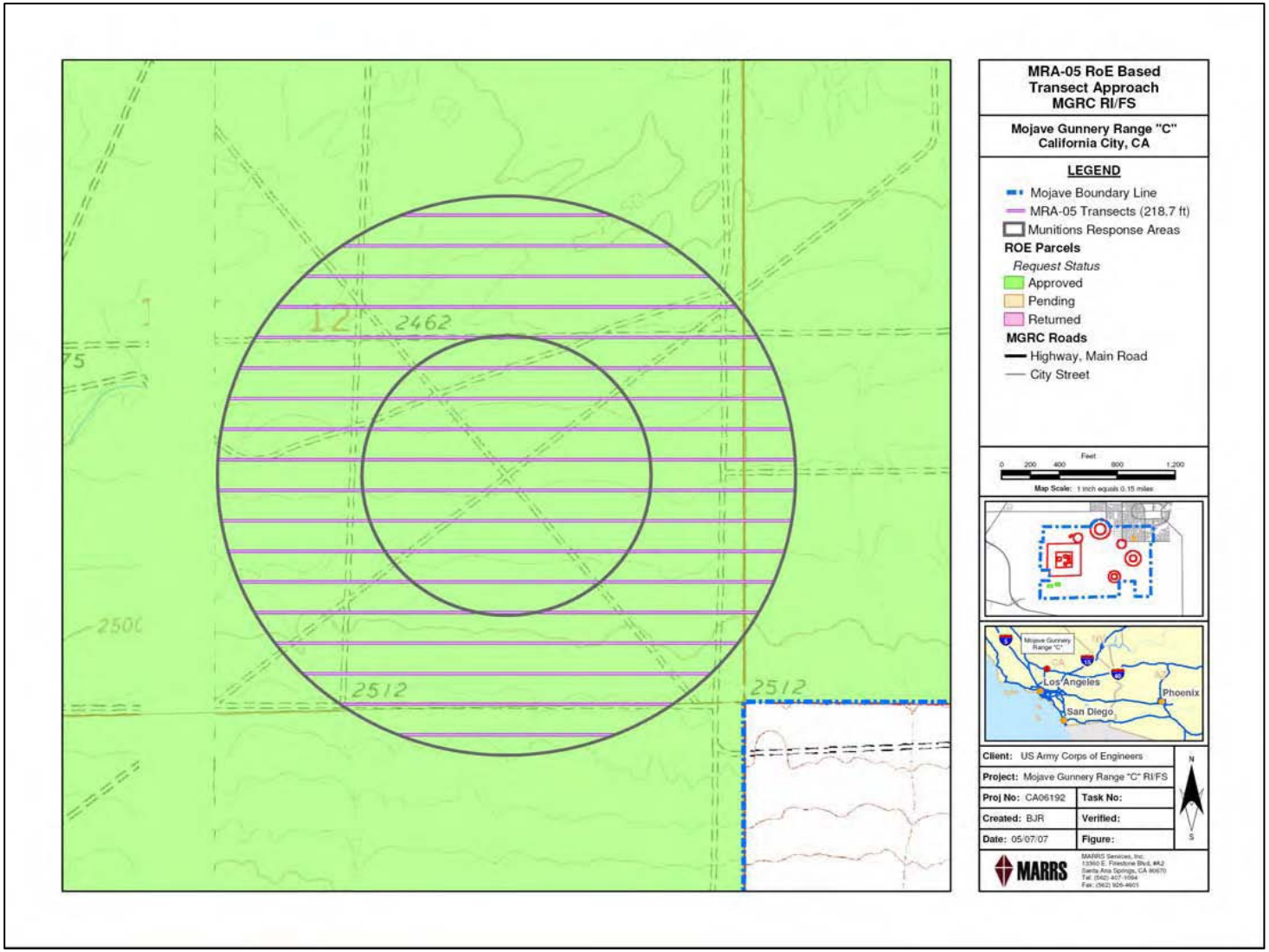


Figure 3-6. MRA-05 Conceptual Transect Coverage Map

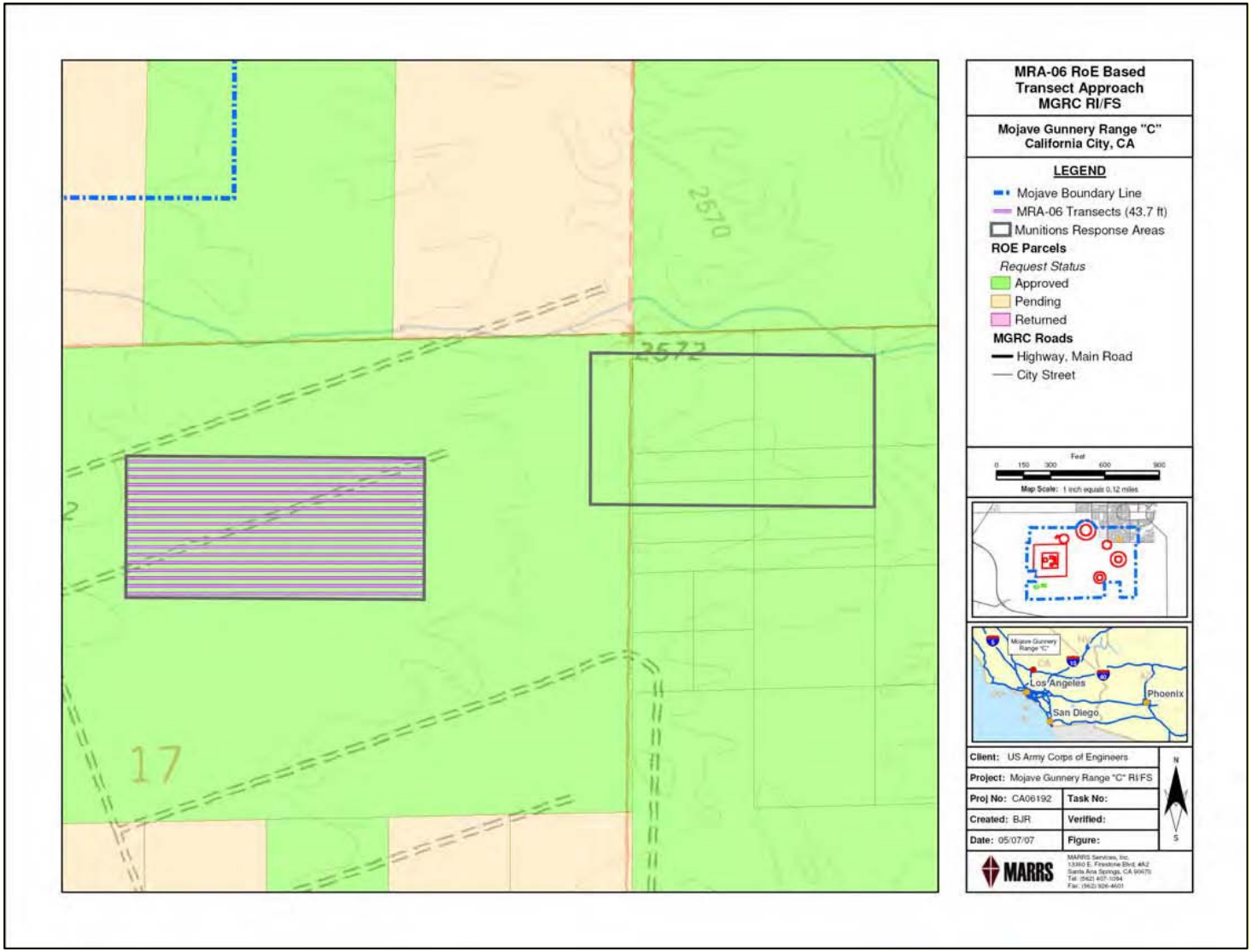


Figure 3-7. MRA-06 Conceptual Transect Coverage Map

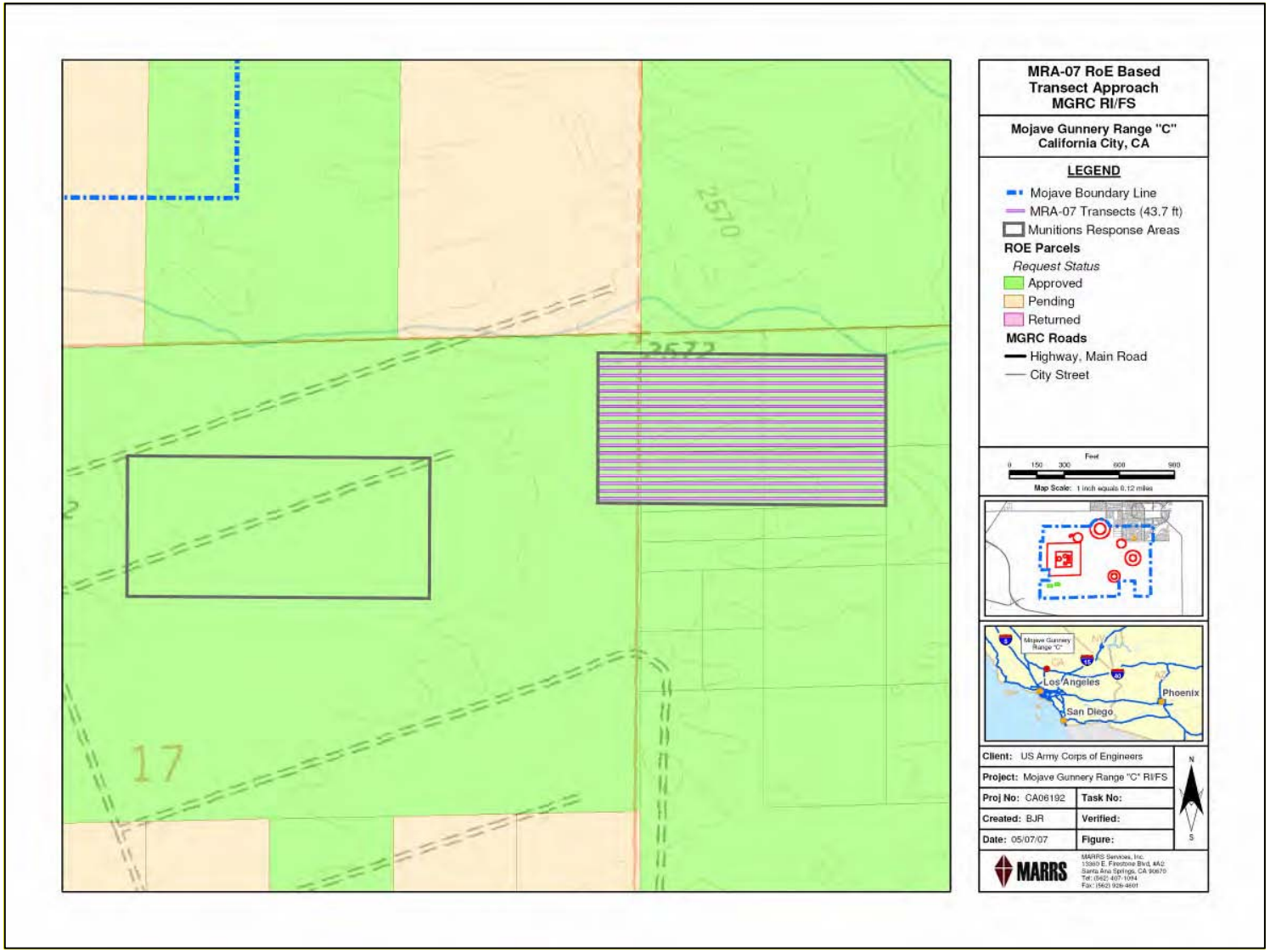


Figure 3-8. MRA-07 Conceptual Transect Coverage Map

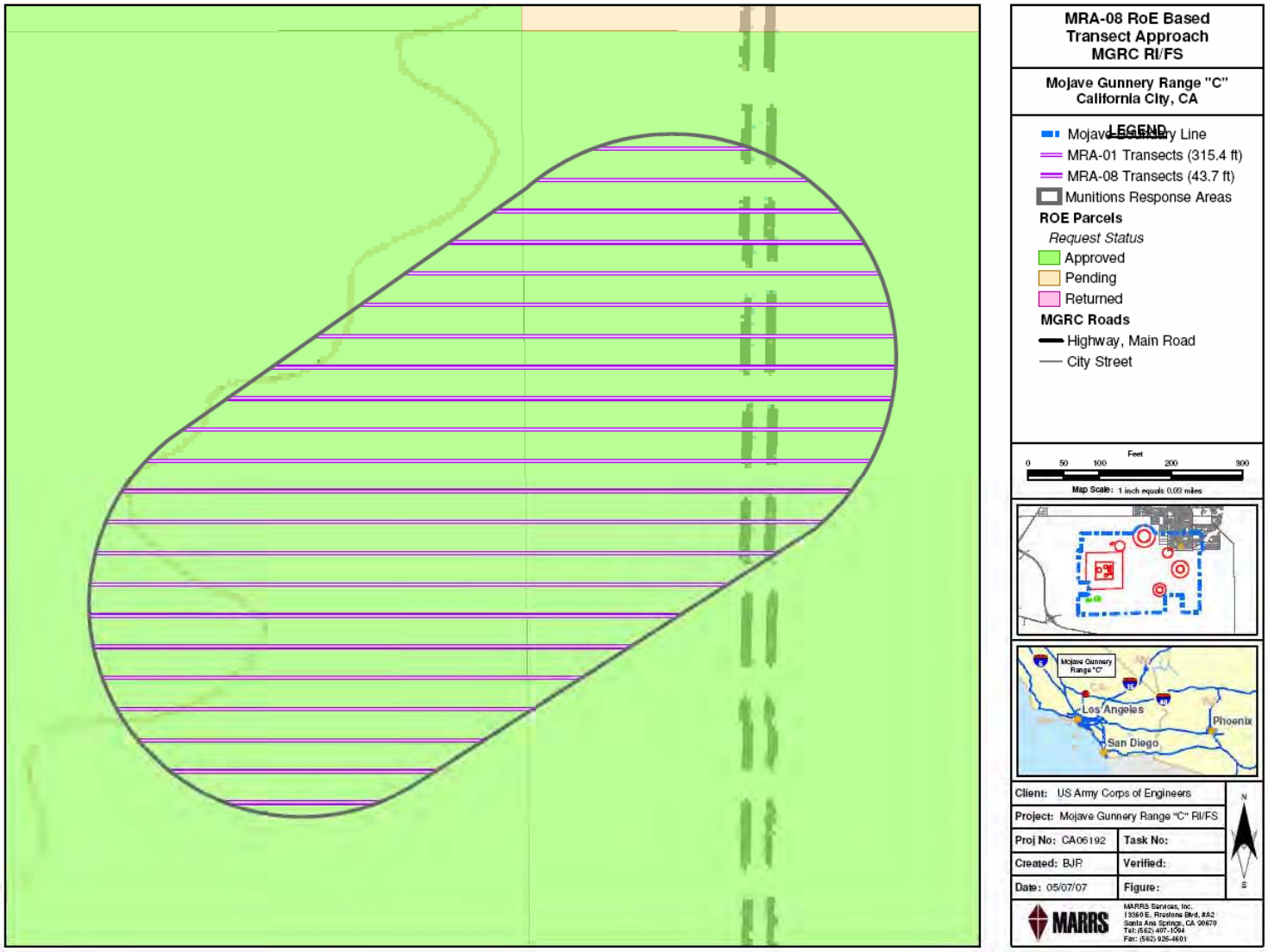


Figure 3-9. MRA-08 Conceptual Transect Coverage Map

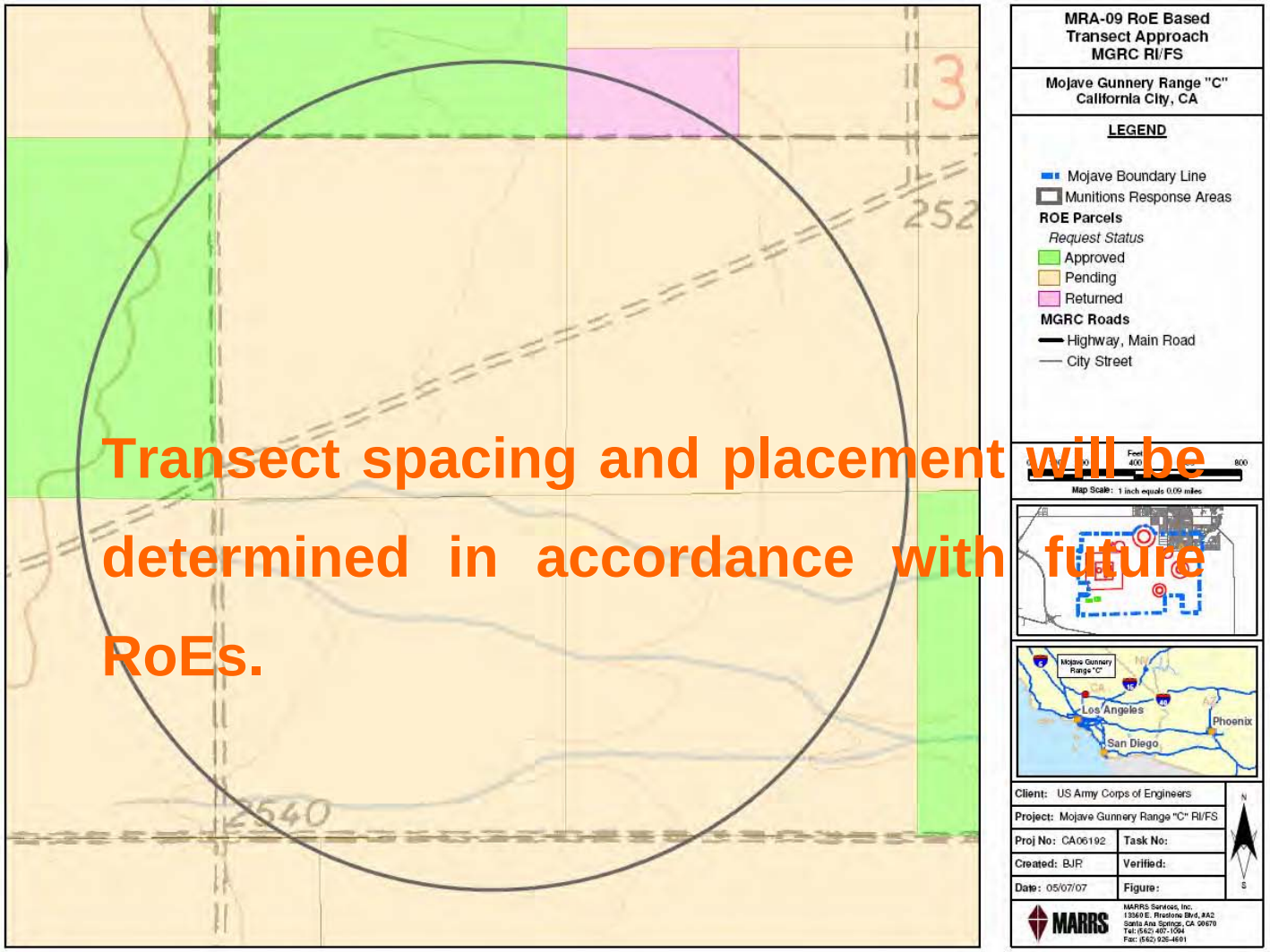


Figure 3-10. MRA-09 Conceptual Transect Coverage Map

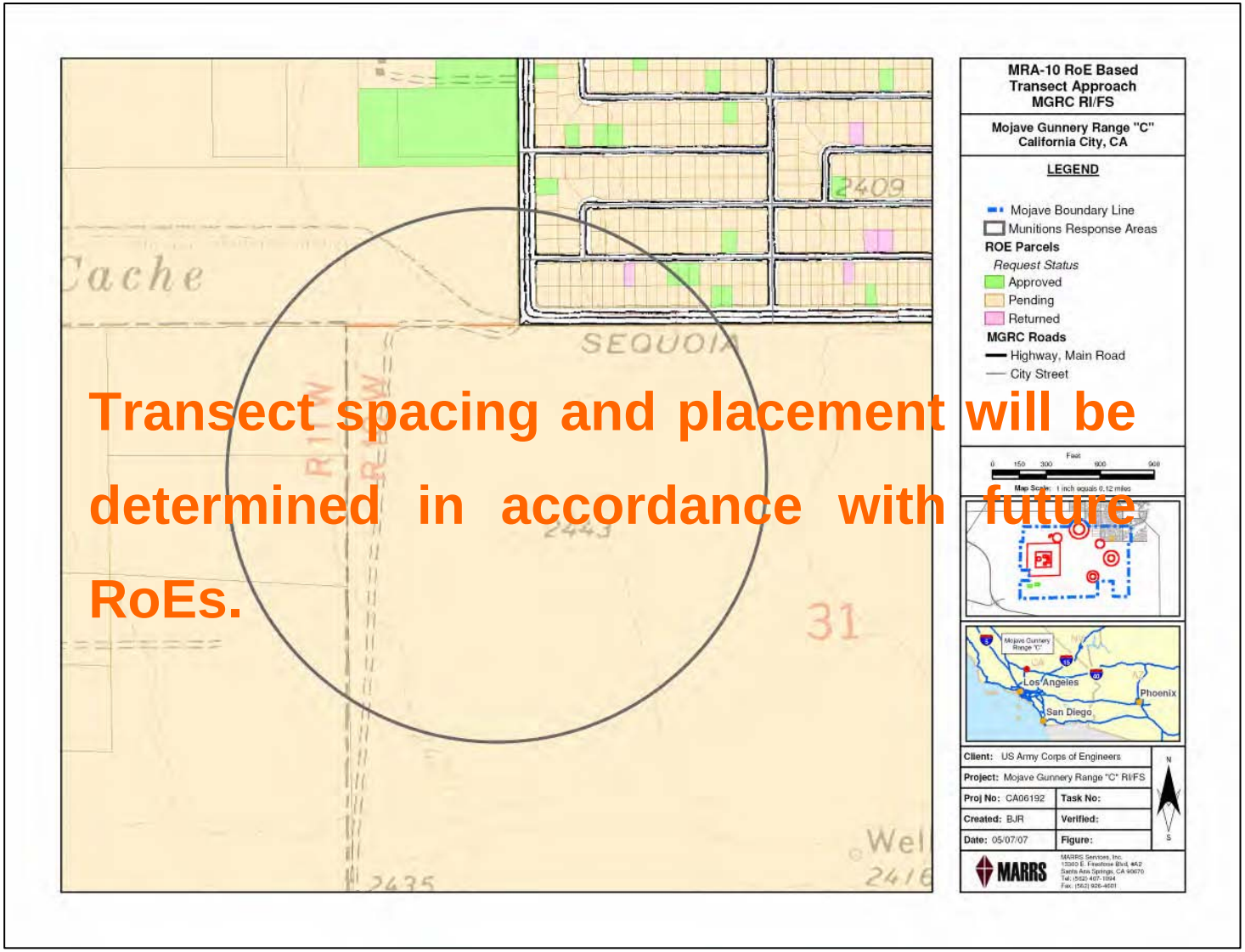


Figure 3-11. MRA-10 Conceptual Transect Coverage Map

3.6.1.3 Past, Current and Future Use

Refer to Section 1.8, Current and Projected Land Use.

3.6.1.4 Anticipated UXO Type, Composition and Quantity

Refer to section 1.10 for a list of MEC items of concern that have been identified as likely to be present within MGRC. Composition of MGRC MEC is mostly steel, with some components made of zinc and brass. The quantity of MEC items within MGRC is currently unknown.

3.6.1.5 Depth Anticipated

Based on site visits and findings in similar terrain, the 20mm projectiles at this location are not expected to be found at depths of greater than 6inches below ground surface. Investigation results from the GPO indicate that the smallest munition of concern (20mm HEI) can be reliably detected to depths of approximately 6 inches below ground surface. This detection depth is consistent with the expected penetration depth of these munitions and should be considered the investigation depth for 20mm projectiles associated with this project.

3.6.1.6 Digital Topographic Maps

Refer to Chapter 1 Section 1.5.1 and Figure 1.2 for a description and map depicting MGRC topography.

3.6.1.7 Vegetation

Refer to Chapter 1 Section 1.5.3 for information concerning MGRC vegetation.

3.6.1.8 Geologic Conditions

Refer to Chapter 1 Section 1.5.4 for information concerning MGRC geology.

3.6.1.9 Soil Conditions

Refer to Chapter 1 Section 1.5.4 for information concerning MGRC soils.

3.6.1.10 Shallow Groundwater Conditions

There are no active rivers or streams cutting through the site. Rainwater is absorbed quickly into the ground without collecting on the surface. The first discernable groundwater is found at 250 feet below ground surface.

3.6.1.11 Geophysical Conditions

There are no documented background geophysical variations at this site other than the naturally

occurring magnetic gradient. The regional total magnetic field is approximately 48,400 nanoTeslas with an inclination of 59.50 degrees and a declination of 13.22 degrees east.

3.6.1.12 Site Utilities

Utilities exist on portions of the site. Information will be provided by the California City Engineer on 6 July, 2007 and will be provided in the next version of this plan

3.6.1.13 Man-Made Features

Numerous man-made features and conditions are present within the survey area that may affect the geophysical investigations. Several proposed subdivisions exist throughout this area in varying stages of road and utility development that may affect our investigations. In addition to the planned subdivisions a limited number of individual parcels have varying degrees of development ranging from former homesteads to fenced lots. Many roads exist across the investigation areas serving as access throughout the site and potential sources for cultural debris and uncontrolled disposal areas. Finally, numerous drainage diversion features have been developed throughout this site creating physical barriers to access across the site.

3.6.1.14 Site-specific Dynamic Events

There are no know dynamic events that will affect the proposed geophysical investigation techniques at this site. However, this area is commonly subjected to high winds that may create logistical problems during performance of this investigation.

3.6.1.15 Overall Site Accessibility and Impediments

The MGRC is characterized by undeveloped sub-divided lands. Site accessibility at the MGRC is controlled by three main factors RoE, biological resources, and terrain (drainage) issues. Numerous roads exist throughout this area allowing efficient access to most of the site. With the main physical limitations being provided by naturally and man-made drainage features and fences surrounding private property.

3.6.1.16 Potential Worker Hazards

Refer to Appendix D, Accident Prevention Plan (APP) for a detailed description of the hazards potential to MGRC.

3.6.2 GEOPHYSICAL INVESTIGATION

3.6.2.1 Survey Type

Geophysical surveys will be performed on noncontiguous roughly parallel transects to collect subsurface data across all MRA areas. Transect paths have been selected to facilitate avoidance of sensitive natural and cultural resources, as well as, avoidance of natural barriers and suspected surface MEC hazards and are not expected to be placed exactly as displayed in the MRA Investigation conceptual maps provided in Section 3.6.1.2. All geophysical data will be acquired using man-portable land based detector systems.

3.6.2.2 Equipment

Only GPO-approved geophysical/positioning methods and equipment will be utilized to collect geophysical data in the MRA areas. As indicated in the GPO the investigation will be performed using the Geonics EM61-MK2 time-domain electromagnetic metal detector coupled with a Trimble RTK 5700 (or equivalent) GPS system. These field data will be recorded on portable field computers utilizing the Dat61MK2 software.

3.6.2.2.1 Survey Platforms

The EM61-MK2 will be deployed using a man-towed wheeled cart array, and the Garrett GTI-2500 will be hand- carried.

3.6.2.2.2 Detectors

Man-deployed wheeled cart and hand-carried detector were selected in accordance with the findings of the GPO. The EM61-MK2 electromagnetic detector will be the primary instrument used to collect data over the majority of the transects requiring subsurface investigation. The Garrett GTI-2500 handheld EM detector will be used for UXO avoidance, assistance with reacquisition subsurface detection in locations inaccessible by the EM61-MK2.

Geonics EM61-MK2 Time Domain Metal Detector

The EM61-MK2 (also referred to as EM61) consists of two 0.5 by 1 meter coils, separated vertically by a distance of 30-cm, which are set on a pair of wheels and pulled by the operator. The EM61 device generates an electromagnetic pulse that triggers eddy currents in the subsurface. The eddy current decay produces a secondary magnetic field that is monitored by a receiving coil or coils. These secondary magnetic fields are received as data and stored in a data logger with the GPS positioning data. The EM61 data logger collects data at automatic

time intervals determined by the user (approximately twelve times per second). The logger can also be set to record data received from the top coil and three different time gates from the bottom coil; or from four different time gates from the bottom coil. For this prove-out, data were logged at a rate of 10 hertz (Hz) and was recorded from the top coil and three time gates of the lower coil.

Garrett GTI-2500 Metal Detector

The Garrett GTI 2500® is a very low frequency (7.0 KHz) metal detector that utilizes a microprocessor controlled digital signal processor (DSP). This unit is a continuously adaptive motion / no-motion, handheld, all-metals detector that responds instantly to targets allowing the operator to search fast, slow or with no motion at all. These units can be operated in one of eight selectable frequencies allowing multiple units to operate in close proximity to each other. The Garrett GTI 2500® is coupled with the 9-inch Scorcher Imaging Search coil enabling the instrument's advanced discrimination capabilities. The system's Auto Track feature allows the instrument to constantly adjust itself to changes in soil conductivity and surface clutter. These units also feature Graphic Target Imaging (GTI) utilizing the Graphic Target Analyzer™ (GTA), TreasureVision™, and TreasureTalk™ providing information regarding target size, depth, and material. An audio response signal is produced when a target is encountered, that increases in pitch and volume as the center of the search coil passes over the target. A Liquid Crystal Display (LCD) is available for visual indication of the relative target size and depth. The LCD also constantly displays battery strength.

3.6.2.2.3 Sampling Rates

EM61 MK2 geophysical data will be obtained utilizing established sampling rates determined during the GPO. Nominally the geophysical data will be acquired at between 8 and 12 hertz (Hz) and correlated with the navigation data. Survey speed will be constrained to ensure that 95% of the measurements along a transect shall spaced be no greater than the maximum data density required to image the smallest munitions of concern for the MRA under investigation. The minimum data densities for each ordnance item will be determined during the GPO process. The Garrett GTI-2500 does not record digital data.

3.6.2.2.4 Navigation and Mapping System

The geophysical survey team(s) will collect data using a real-time kinetic (RTK) GPS (Trimble, Leica, Topcon, or other system that meets required performance specifications) with 8-inch (20-cm) precision. The GPS satellite clock time will be used to time-stamp both position and sensor data information for later correlation. Position dilution of precision or horizontal variance calculations will be provided as part of the data stream. The GPS shall simultaneously record position along with geophysical response data. The Universal Transverse Mercator (UTM), Zone 11S, meters grid coordinate system will be used and referenced to the National Geodetic Survey (NGS) NAD83. The GPS antenna will be centered over the geophysical array and fixed relative to the array. Error introduced by erratic motion of the antenna is not expected to be

larger than 0.5 m (1.6 ft). Error will also be introduced by sloping topography based on the height of the GPS antenna relative to the array. This error will result in anomaly sources being located uphill in the direction of maximum slope from the targeted locations. The amount of offset increases as the slope increases. Reacquisition/Dig teams will be instructed on the error and may increase their search radius in the uphill direction from the target location. As the site is relatively flat, the occurrence of this error will be minimal. The RTK GPS will also be used to position MD or MEC discoveries during handheld EM surveys.

Where an acceptable GPS signal is not available due to trees, steep canyon walls, or any other impediments, a fiducial system will be used with data collected at a constant rate between two known points. The data point locations will be interpolated between the two known points during data processing.

The geophysical survey team will continuously track and monitor the position of the instrumentation array during data collection to ensure coverage of the areas of interest. This will be accomplished through the use of lane markings and by maintaining alignment of the instrument array relative to transect waypoints (e.g., GPS navigation, cones, lath, flagging).

Structures, trees, or topography that would obscure the sky and degrade satellite coverage may be present along some portions of transects. These will be noted in the daily field logs. No geophysical data correlated with GPS positioning from less than six satellites or horizontal precision of less than 20 cm (8 in) will be used. Work/rest cycles will be planned around satellite-availability periods for maximum production.

3.6.2.2.5 Data Processing System

Equipment - Data will be processed using standard, IBM-compatible PC platforms.

Software - Processing software will be comprised of downloading routines specific to the geophysical and positional instrumentation deployed, Geosoft Oasis Montaj, MicroSoft Excel, Word, and Access programs.

Personnel - Data will be downloaded and processed by personnel who have a minimum of 3 years experience processing geophysical and positional data similar to that which will be collected for the Volume 3 investigations.

Location/Facilities - Data will be processed in a local field office set up for the MRA site investigations on or near the project areas. Facilities will include electrical, telephone, and facsimile connections, environmental control (heating and air-conditioning), PCs, printers, a plotter capable of producing American National Standard Institute (ANSI) D-sized graphics, and high-speed Internet connection.

3.6.2.3 Procedures

3.6.2.3.1 General

Geophysical surveys will be conducted on generally parallel transects with site-specific orientation with transect spacing determined based on range type and munitions by two- or three-person field teams using man-portable carts. A UXO escort will accompany the geophysical field teams to guide them away from potential MEC hazards.If natural/cultural monitors have not accomplished surveys during the surface visual surveys, monitors will also accompany the team to ensure environmentally sensitive locations are protected. Transect path and spacing will be dependent on RoE parcel access, terrain, and vegetation cover. Transect paths will deviate from the planned transect paths to avoid hazards and obstacles.

Avoidance, for natural resources, will be accomplished by two basic and interrelated methods. A) Research and Mapping will be the first methods where natural resources are identified based on currently available information and transects are planned accordingly. B) On-site monitoring will be the second method (an ongoing method) and will include site-specific training and/or an on-site biologist and transects will be modified accordingly. RoE access will also constrain the final acquired paths. Additional transects or grids may be used to help answer specific questions about MEC contamination and concentration in narrower target areas or where data gaps are identified in the post processed data.

3.6.2.3.2 Digital Geophysical Mapping (DGM)

Hand-towed systems using a single EM61-MK2 will be employed for general production DGM to identify the locations of buried objects. Location tracking and transect identification will be accomplished using RTK GPS to report current location, allowing teams to identify their map location and adjust their path to reduce deviations from the original planned transect. In areas where RTK GPS signal is poor or unavailable a combination of robotic total station (RTS) positioning and dead reckoning may be used. RTS or dead reckoning may be used for areas requiring extensive data coverage. Dead reckoning will be performed on a station to station basis using surveyed lath as control points for transects. Because of RoE considerations, teams will likely be issued multiple transect segments crossing the same RoE or groups of RoEs rather than long, continuous transect segments in some areas.

The following steps will be performed as part of DGM activities for each data file:

1. Pre-survey equipment check (batteries charged, etc.)
2. Attend morning briefing, site safety brief, receive instructions and maps
3. GPS power on, location check (on test strip)
4. Mobilize to survey area
5. Pre-Operation equipment inspection/set up

6. Power on equipment and equipment warm up, initialization
7. Cable shake test
8. Conduct static, reference, and dynamic checks
9. Map transect segments
10. Perform final static, and reference checks
11. Return to field office, download digital data
12. Prepare and sign/date field logs and documentation

Throughout steps 1-14, the field team leader will be responsible for recording and maintaining QC documentation and field notes for each step as they occur. File naming conventions will be maintained (include date, sequential number for day, transect), and periodic downloads of data made as necessary.

3.6.2.3.3 Handheld EM Surveys

Handheld EM surveys will be conducted in areas where the maneuverability of the EM61-MK2 is limited. This type of survey requires operators using Garrett EM detector magnetometers to identify anomalies in the field by walking 3-foot wide lanes between known points. Upon indication of a subsurface anomaly, the anomaly locations will be investigated by the crew performing the survey. Digital geophysical data from these surveys are not recorded in a data logger as with the EM61-MK2. Records detailing the material recovered from each of the intrusive investigation performed will be kept on a field computer-based dig sheet. However, the location of each anomaly will not be recorded unless the item recovered is MEC-related. If MEC related material is recovered, the item's location will be recorded using GPS or will be measured from a surveyed point using measuring tapes.

3.6.2.3.4 Records

The geophysical field team(s) will maintain a daily log that details pertinent activities, survey lane features, and field conditions encountered in the performance of the geophysical investigation. A field sketch map of surveyed areas will be maintained as the geophysical data collection progresses. Field maps will note date/time of the survey, area covered, and the location and description of noise sources that will affect interpretations. These will be reviewed daily. The field data sheet (Attachment A of USACE DID MR-005-05) will be completed daily by each geophysical team. The daily log will document:

- Morning pre-survey checks of instrument and batteries
- Safety and planning briefing
- Team designation and members
- Weather conditions

- Identification of traverse segment(s) to be geophysically mapped
- Equipment set-up
- Definition data file names
- Initialization of data logger(s) to record geophysical response
- Performance of instrument standardization
- Traverse of transects to collect data
- Any interruptions to mapping progress or system problems
- Verification of complete investigation of all segments
- Delivery of digital data to the MARRS Senior Geophysicist (or designee)

3.6.2.4 Personnel

All key personnel are listed and their responsibilities outlined in Section 2, Technical Management Plan.

3.6.2.5 Production Rates

Production rates will vary depending on the instrumentation and area being investigated. Given limitations imposed by weather, terrain, and array operating requirements, actual survey traverse speed is expected to average 2 to 3 mph. Taking into consideration time for conducting daily operations and safety briefings, equipment standardization tests (before and after surveying), mobilizing equipment and crew to the survey line, periods of low satellite coverage for GPS, downloading data, and conducting daily maintenance and productivity, production rate is expected to be approximately 2-4 miles per day per array.

3.6.2.6 Data Spatial Density

Data resolution along the line will be sufficient to discriminate individual munitions that have been identified as the smallest munitions of concern within the MRAs. Station intervals along a transect shall be spaced no greater than the maximum data spacing required to image the smallest munitions of concern for the MRA under investigation. The data spacing for each ordnance item will be determined during the GPO process. The acceptance criteria for transect data in the case of 20mm HEI will require that 98% of the data obtained will be spaced at or below the required 20 cm sample interval, areas that exceed this performance criteria shall be evaluated for cause and corrective actions recommended. Line spacing will be assigned within the site-specific addendum for each MRA. This spatial density is required to meet the DQOs. In addition to regular transects, some areas may be sampled with a finer line density to provide more intensive investigation.

3.6.3 Instrument Standardization

Refer to Attachment B of USACE DID MR-005-05 for minimum test frequency requirements and acceptance criteria.

Proper operation and function of the instruments used will be checked and documented in the field log each day by standardization processes prior to the day's geophysical surveys. Baseline responses and standardization acceptance ranges for the mapping systems will be established before any geophysical mapping is performed. A static background response test of no less than 3 minutes shall also be conducted coincident with instrument standardization checks. The purpose of this test is to identify unusual variations in the instrument response. Specifically for the EM 61 MK2, maximum peak to trough variation of larger than 2.5 mV on the third time-gate will trigger a review of the equipment and affected data.

Additionally, a two-point positioning reference test will be performed at the beginning and end of each day. Measured position coordinates and the difference between daily measurements and the known position will be recorded on the field data sheet. Measurements that vary more than ± 20 cm (± 8 in) will trigger a review of the GPS equipment and affected data.

Standardization of each system will be performed at the beginning of each day to ensure proper operation and function of the system, including before and after each transect survey and/or prior to equipment shut down. This will be accomplished by establishing a target and background reference geometry and determining the numerical difference between target-anomaly high and background response of each system. Standardization consists of comparing the residual anomaly to the standard response acceptance range, and recording the values in the daily logs. The acceptance range is specified at ± 20% of the standard response (calculated mean residual anomaly).

Static background readings (static background response test) will be collected for at least 60 seconds at the frequency that data will be (or were) acquired. The standard target will be inserted and target data recorded for 60 seconds at the used operating frequency. The difference between target and background provides the residual anomaly response used in the standardization check. Multiple anomaly-versus-background measurements will be made to allow computation of a mean residual (anomaly response) and calculation of a standard deviation specific to the system.

Dynamic tests will be conducted at the beginning of each survey file over the local test strip. This dynamic test will be used to evaluate both latency and dynamic noise levels.

.The standardization response and acceptance range will be recorded in the geophysical survey field logbook assigned. If a system component does not respond within the acceptance range, the standardization measurements will be repeated. Three sequential failures will cause the system to be removed from service. Any failed component must be repaired/replaced and a new standard response (with a new standard deviation and acceptance range) calculated

before being redeployed to the field. Static, reference, location, and latency checks will be recorded electronically, and results included as part of daily deliverables of geophysical data.

Field tests over a geophysical test plot will not be a part of the daily routine. However, all instrumentation will be deployed over a representative geophysical prove out (GPO) equipment evaluation plots to establish a baseline response and validate instrument performance prior to use for collecting field data. The standard and array baseline responses will be recalculated whenever any critical component of the instrumentation system is repaired or replaced, or as changing survey conditions warrant.

3.6.4 DATA PROCESSING

3.6.4.1 Initial Field Processing

Geophysical data (amplitude and location) will be downloaded periodically to avoid possible data loss or corruption. All collected data, including field notes, maps, standardization and other QC documentation, and digital data, will be delivered to the MARRS Senior Geophysicist before the close of each day's activities.

The geophysical field data shall be checked, corrected, and processed into American Standard Code for Information Interchange (ASCII) files. Data file names, transect numbers and location, fiducial marker locations, and transect start and end points (as applicable) will be recorded in the daily log and data processing logs. The data shall be presented in delineated fields as x, y, z, and v(1) to v(n), where x and y are coordinates, z is the instrument elevation above sea level, and v is the channel (time-gate) response. Field processing will include a symbol posting of the measurement stations along the survey lanes, and generation of response profiles of the data measured at each of the geophysical receivers of the array versus time. A visual inspection of the data will be performed to identify any single-point anomalies, steps in response, incoherent signal, or excessive noise bandwidth. All such events will be noted and the processing utilized to correct and/or remove these events will be described in the field logbook. Data dropouts or inexplicable data shortages, if not detected during the field review and scheduled for reacquisition, will be evaluated to identify the root problem and steps needed for resolution.

A field data sheet (in accordance with USACE DID MR-005-05) will be completed and submitted daily for each survey team and system.

3.6.4.2 Standard Data Analysis

All corrections, edits, filtering, or normalization of the data used to identify potential MEC anomaly locations will be fully documented in a data processing log. Positional offset between the instrument measuring point and navigational reference datums will be corrected. The field logs will record these offsets, both at the beginning of the day and during data collection; particularly any changes to the configuration of the field arrays that may cause data processing errors will be highlighted. Any discrepancies in positional accuracy of the data noted during the

field review will be described, including steps taken to correct or resolve any QC issues. The landmarks, fiducials, and anomaly locations represented in the processed geophysical data will be compared to geophysically-referenced spatial data (GIS base maps). The features of the GIS that are reflected in the geophysical data should be coincident to within 0.5 m (1.6 ft). Locations that are more precise will not be possible based on limitations imposed by the instrument geometry, the GPS accuracy and processing parameters.

Data collected by different systems shall be demoded (if necessary) to set background levels for each system equal to the same datum. Any sensor biasing, background leveling, or standardization corrections accomplished in the field will be noted in the daily logs. Data will be corrected for navigation errors, timing errors, instrument bias, and measurement drift. Instrument drift will be corrected using non-linear, spatial high pass filtering which acts to subtract an "average" response value calculated over an area from the actual response. This filter does not distinguish between regional variations in response and instrument drift. Data processing to accommodate these data inputs are to be fully described in the processing logs. All processed data will be compared with the raw data to insure that significant anomalies have not been eliminated during processing.

To assess usefulness of the data for detecting and resolving MEC anomalies, noise levels in the data will be analyzed to ensure that they are sufficiently low to allow adequate signal-to-noise differentiation of pertinent anomalies. If it can be clearly discriminated in the field data, motion-induced noise will be removed from the data, as will quantifiable transient noise.

Automated picking algorithms will be used to select target anomalies for potential intrusive activities. Geophysical targets will be classified based on amplitude, size, time constant, and decay rates. The transect track and the locations of the anomalies will be plotted on a planimetric map. Project geophysical staff will screen potential anomalies and compare anomaly locations with field notes to identify anomalies resulting from cultural clutter. Additional anomalies may also be selected for potential intrusive activities by the project geophysical staff by visual inspection of the data.

3.6.4.3 Advanced Data Processing, Digital Filtering and Enhancement

The depth to anomaly source will be estimated using either a half-amplitude, full-width criterion or other modeling/estimating methods. The time decay curves produced using the multiple time gates of the instrumentation will be analyzed to attempt to improve identification of metallic versus "false positive" responses. In addition to the decay curve the time constant of the EM data will be calculated to provide information regarding target size and clutter evaluation. Any variations or results not compatible with prior results or expectations will be reviewed with the Site Geophysicist to determine causative features that may be present.

3.6.4.4 Anomaly Selection and Decision Criteria

Anomaly investigation is accomplished by identification of discrete responses distinct from

background response levels. Validated software and manual data review will be used to select suspect anomalies and print out target lists ("dig sheets") for the reacquisition of sampling locations. Software "validation" will be understood to exist for commercially available programs, or through submittal of software documentation sufficient for the reviewing geophysicist to understand the logic and algorithms used in the processing. The target selection criteria were developed using the GPO, found in Appendix I, will be applied to the MGRC field data.

Anomalies will be tabulated in an ASCII file and will be delivered to CESPL and the MARRS SUXOS in accordance with USACE DID MR-005-05. Tabulated anomalies will have an anomaly number, location (easting and northing) in UTM coordinate space, peak amplitude, and estimated depth to target. A table will be developed and progressively updated that presents pertinent anomaly data (e.g., anomaly identity, amplitude, width, apparent source, depth-to-target).

Anomaly symbols and identification numbers will be superimposed on the track covered by the geophysical transect surveys. An ASCII-format tabulation of the anomalies will also be generated. The table will include: anomaly number, easting and northing (in UTM coordinates), anomaly amplitude, and other anomaly attributes (e.g., depth estimate).

3.6.5 Dig Sheet Development

An intrusive investigation target list will be developed in accordance with Attachment C of USACE DID MR-005-05 and managed within the project GIS.

3.6.6 Anomaly Reacquisition

Anomaly locations identified by MARRS will be recovered using the EM61 MK 2 in conjunction with RTK GPS equipment capable of centimeter grade accuracy to navigate to the coordinates of each predicted geophysical target identified during DGM data processing and interpretation.

The anomaly reacquisition team will refine the anomaly location using an EM61-MK2 and methods that were demonstrated and approved at the GPO.

A geophysical reacquisition team will use an RTK GPS system to determine the location of the anomaly based on the UTM coordinates reported on the field computer dig sheet. Reacquisition teams will search a 3-foot radius area using the EM61-MK2 to delineate the exact location of the anomaly's peak. If the anomaly is found, a pin flag will be placed at the actual anomaly location. The signal response, offset distance, and direction from the re-acquired location will be noted in the field computer. If the anomaly is not found a probable source for the reacquisition failure will examined.

Generally offsets from the reacquired locations to the actual anomaly locations are expected to be within 3 feet for grid-based data. However, this may not always be the case for transect data where it is possible that large metallic objects could be detected by the EM61-MK2 much farther

than 3 feet from their actual locations. This means that the source of a transect anomaly could be well outside of the 3-foot search radius. For this reason, any response detected within 3 feet of a transect or meandering path reacquisition point will be tracked to its source, regardless of the distance from the reacquisition point. Another source of positioning error may be introduced by sloping topography based on the height of the GPS antenna relative to the array. This error will result in anomaly sources being located uphill in the direction of maximum slope from the targeted locations. The amount of offset increases as the slope increases. Reacquisition/Dig teams will be instructed on the error and may increase their search radius in the uphill direction from the target location. As the site is relatively flat, the occurrence of this error will be minimal. If the reacquisition team cannot identify the target anomaly, the original anomaly coordinate location will be marked and the location may be revisited by the original geophysical instrumentation to confirm the presence of anomalous response (and then excavated) as directed by the site manager.

For areas geophysically surveyed using the handheld Garrett GTI-2500, detected anomalies may be intrusively investigated immediately or flagged and the position recorded using GPS for future reacquisition and investigation.

3.6.7 Feed-Back Process

The field anomaly map, digital data image, and MEC sampling results for each transect investigated will be compared by the project geophysicist to ensure the discovered sources are representative of the anomaly signature. If the site Geophysicist and QC manager determine that a reinvestigation of the geophysical target is necessary based on a set of field results, the anomaly location will be reassigned as a target for reacquisition. This reexamination is intended to determine if a detectable anomaly is still present or if conditions at the location have changed since the first reacquisition effort. The criteria for re-flagging a QC anomaly will be identical to the initial reacquisition criteria.

3.6.8 Quality Control

The QC measures being instituted for the project, including geophysical QC are included in Section 4, Project Quality Control Plan.

3.6.9 Corrective Measures

If any deficiencies are discovered, corrective action will be dependent on the specific issue discovered. QC discrepancies noted in survey equipment will be recorded, as will discrepancies between data DQOs and the field data for the project. Initially, an attempt will be made to repair or replace the equipment or refine field procedures. If the discrepancies can't be addressed by fixing equipment or procedures in the field, then a root cause analysis of the discrepancy will be generated and submitted to USACE representatives. The MARRS site and project representatives will discuss the root cause analysis with the USACE to determine whether or not the project DQOs are actually achievable, given conditions on site. The DQOs may need to

be altered based on these analyses.

3.6.10 Records Management

A daily log shall be maintained that details pertinent activities, site features, and field conditions encountered during performance of the geophysical investigation. All daily notes will be recorded in bound field notebooks; digitally captured data will be copied to archive disks each day; and all data files will be accompanied by Microsoft Word® or Adobe Acrobat® documents detailing file content, file naming, and data processing performed on the field data.

Field processed data will be delivered to the MARRS SUXOS no later than 1 working day after data collection. Electronic copies of the downloaded (raw) and edited (processed) data files will be delivered to the MARRS SUXOS within 2 and 4 working days, respectively, of data collection. The identified anomalies will be delivered to the SUXOS no later than 4 working days from the collection date. Digital data will be archived to document the geophysical investigation, including thoroughness of the survey, detection efficiency, and locations of identified anomalies; provide a means of quantifying the confidence that can be applied to the RI results; and preserve and document the extent, precision, accuracy, and quality of the geophysical investigation. Geophysical data will be transmitted to the CESPL to meet interim reporting requirements and upon completion of the field activities.

3.6.11 Interim Reporting

Raw geophysical data will be submitted one business day after collection. Processed data, including the picked anomaly locations, will be delivered within one week of data collection. Intrusive investigation results will be submitted at the end of each week. It is anticipated that all data deliverables can be submitted to the USACE via upload to a project-specific file transfer protocol (FTP) site. If submittal in this manner is not acceptable or not feasible given conditions at the site, a digital video disk (DVD) including all of the deliverables referenced above will be compiled at the end of each week and will include the data from the previous week When submitted, map format shall be as provided in Attachment D of USACE DID MR-005-05.

3.7 GEOSPATIAL INFORMATION AND ELECTRONIC SUBMITTAL

All final mapping will be generated using GIS. The size of these drawings will be based on the information to be displayed. The location, identification, and coordinates of the control points will be plotted on the maps (the surveyor's control points will be provided to the USACE) along with any other predominant physical features in the area shown. Each map will include grid orientation to true north and magnetic north, with the differences between them shown in minutes and seconds. Grid lines or tick marks in feet and at systematic intervals will be shown with their grid values on the edges of the map. A legend showing the standard National Geodetic Survey symbols used for the mapping, a map index showing the site in relationship to all other sites within the boundary lines of the project area, a border, and a standard USACE title block also will be shown on each map.

The GIS effort will involve preparation, analysis, processing, and interpretation of data acquired during land surveying, land-based geophysical surveying, and intrusive investigative operations. GIS activities will be performed in accordance with DID MR-005-07. The GIS coordinator will be responsible for processing and registering all survey and intrusive data collected in the field into the site GIS and also for preparing maps depicting specific attributes for investigated areas. The GIS data will be submitted in ESRI ArcGIS format in the UTM coordinate system.

3.8 INTRUSIVE INVESTIGATION

3.8.1 General Methodology

Subsurface investigations will be performed within surveyed areas on all anomalies selected by the Site Geophysicist. Intrusive investigation teams, consisting of at least two UXO-qualified individuals and equipped with an EM61-MK2, RTK GPS, field computer and hand digging implements will conduct excavations. A visual and electronic search of the excavation will be made until the anomaly is located. If the subsurface target is unable to be located, the data for undiscovered anomalies will be reviewed by the project geophysicist and the MEC team supervisor(s). If there are no clear surface sources (e.g., terrain, vegetation, cultural clutter), and the data at that specific site is determined critical to meet the RI/FS DQO, the locations will be revisited with the original geophysical system to confirm anomalous response. If an anomaly is verified, the investigation will be to depth of detection.

Upon excavation, the intrusive investigation team will record the location, identification, and attributes of the excavated item (either manually on a dig sheet or electronically in a field computer). In all cases where occupied structures may be within the pre-established exclusion zone (EZ) distance, an engineering control, such as a Miniature Open Front Barricade (MOFB) aka “Bud Light” or other equally protective control measure will be used to preclude having to unnecessarily evacuate occupied structures. The EZ is based on the minimum safe distances discussed in Chapter 6. This procedure will be followed whenever an inhabited building is within the pre-established EZ distance for the munitions listed in Chapter 6. An exception to this requirement will be observed in those MRAs where the MGFD is based on the M65A1 1000-lb GP HE bomb. In these MRAs, the project geophysicist will identify geophysical anomalies that are consistent with a 1000 lb bomb. If no such anomaly is identified by the project geophysicist then the EZ will be reduced appropriately to preclude unnecessary evacuation of inhabited buildings that would normally fall within the 3882 ft EZ. In the event an ordnance item other than those listed in Chapter 6 is encountered, the USACE OE Safety Specialist and the UXOSO will make the determination as to what procedures need to be taken (to include evacuation).

MEC located during the subsurface search will be reported to the SUXOS. A description of all MEC, munitions debris, and non-munitions debris recovered will be recorded and incorporated into the project database. Recorded data will include, where possible, size, estimated weight, orientation, depth bgs, and description of the item excavated.

If acceptable to move, suspected or known UXO/MEC will be placed into the on-site explosives

storage magazine (location shown in Chapter 6 Figure 6-8) for destruction at a later date. Munitions debris will be inspected and certified as free of reactive constituents prior to being placed in a lockable storage container.

After confirming that the item causing the anomaly was removed, excavations will be back filled and tamped. The excavation site will be returned as nearly as feasible to an undisturbed condition.

3.8.2 Accountability and MEC Records Management

A detailed accounting will be made of all UXO items encountered during the RI activities. This accounting will include the nomenclature (if applicable) type, approximate weight, depth, orientation, condition, and location of the item indicated. The UXO Tech III (team leader) will record specific details regarding the material found, including (but not limited to), the following: specific nomenclature, type of fusing, condition, and external markings. The X, Y, and Z coordinates and disposition of the item also will be recorded. Each suspected UXO item encountered will be entered on the Daily Operations Summary.

The SUXOS will prepare and submit the Daily Operations Summary using the Daily Field Activity Report and/or disposal record. The SUXOS will provide copies of the Daily Operations Summary to the MARRS PM. The intrusive investigation data will be compiled on a weekly basis and sent to MARRS Escondido office for review. Excavated anomaly attributes will also be added to the project GIS database.

UXO items that can be moved to the explosives storage magazine will be transported to the magazine for storage, pending demolition at project completion. The SUXOS will be responsible for reconciling the count of MEC items within the storage magazine with the project database. The inventory count of MEC items will be conducted by the SUXOS and UXOQC/SO on a weekly basis and any discrepancies with the project database will be reported immediately to the USACE OE Safety Specialist, MARRS PM, and the USACE PM.

3.8.3 UXO Personnel Qualifications

Each intrusive investigation team will be comprised of at least one UXO Technician II and a Technician III. It is anticipated that three intrusive investigation teams will be utilized during the RI. In addition, a SUXOS and UXOQC/SO be on the project site during all intrusive investigations. The qualifications for these personnel are included in Chapter 2, Technical Management Plan.

3.8.4 MEC Sampling Locations

UXO personnel will excavate subsurface geophysical targets identified, as a result of the geophysical mapping and data evaluation effort, and picked for excavation using the RI/FS DQO methodology and model. Therefore, MEC sampling locations will be along the same path

that the geophysical investigation teams used to collect the subsurface data. The planned routes for geophysics and MEC sampling, illustrated in Section 3.6.1.2, are conceptual in nature and are subject to change slightly in accordance with site topography, vegetation and avoidance of sensitive species habitat. During the field activities, revised field maps will be generated that illustrate the actual paths taken with anomaly points picked for MEC sampling for use by field crews and QC personnel.

3.8.5 MEC Sampling Procedures

3.8.5.1 Subsurface MEC Investigation

The equipment requirements for this activity include:

- Instrumentation EM-61 MK2 and hand-held, Garrett GTI-2500, used to identify the geophysical target and assess proximity to subsurface metallic anomalies and/or MEC during progress of excavation.
- Miscellaneous common hand tools (e.g., screwdrivers, digging implements)
- Field computers, forms and logbooks to record activities

The EM61 MK2 will be used to initially identify the geophysical target and confirm the relative response matches the response of the target identified for investigation. The handheld Garrett will be used to refine the position of the anomaly during excavation. Each instrument will be checked daily at a standard location to ensure proper equipment function and operation.

3.8.5.2 Near-Surface Anomalies

Near-surface anomaly sources are those that are partially exposed or suspected to be within 1 ft of the surface and that can be excavated using hand tools. These anomalies will be excavated by carefully removing the earth overburden using a hand shovel/trowel or other small digging implement. Throughout the excavation, the UXO Technicians will use the Garrett GTI-2500 metal detector to check and verify the proximity of the anomaly source.

3.8.5.3 Subsurface Anomalies

Subsurface anomalies are those caused by sources that are more deeply buried > 1 ft bgs. Manual methods will be used to excavate all subsurface anomalies due to the occurrence of natural resource constraints. Manual digging tools will be used to excavate the earth overburden in 6 in lifts. After each lift, the anomaly location will be redefined with the Garrett GTI-2500 metal detector and the anomaly source sought using hand tools. This process will continue until the source of the anomaly has been uncovered and identified.

3.8.5.4 MC Soil Sampling

Soil sampling for Munitions Constituents (MC) will be performed at selected locations where visual and geophysical data indicate the presence of MEC. Additionally, pre- and post-BIP soil sampling will be implemented during the RI field data collection process at locations where a blown-in-place (BIP) disposal of MEC is prescribed and conducted. These samples will be collected and analyzed to evaluate what, if any, contaminates may remain at MRAs as a result of prior military actions and if they would contribute to an environmental risk to site workers or the public, as well as ecological receptors. The Sampling and Analysis Plan (SAP) will present the Data Quality Objectives and procedures that will be used during the soil sampling process. The SAP can be found in Appendix G of this document.

3.8.6 Munitions with the Greatest Fragmentation Distance

Different types of munition items were fired into and dropped onto the former MGRC. An MGFD has been determined for each MRA based on known or suspected MEC within each MRA. If fragment producing UXO are encountered or UXO are found where they are not expected, the Quantity/Distance (Q/D) arcs will be adjusted or created as required and an amendment to the RI Work Plan will be submitted for approval. Further details on the MGFD for each MRA and its associated Minimum Separation Distances (MSD) are contained in Chapter 6 Explosive Siting Plan Table 6-1 Minimum Separation Distances (MSD)

3.8.7 Minimum Separation Distances

The Minimum Separation Distance (MSD) for intentional and unintentional detonations shall be as follows:

- **Unintentional Detonation** MSD for the public or non-essential personnel during MEC intrusive (subsurface excavations) operations at MGRC will be the Hazardous Fragment Distance (HFD) based on the hazard assessment at paragraph 6.1.1.2. Team separation distances (TSD) will be maintained at K40 distance, as identified in Table 6-1.

- **Intentional detonation** MSD will be the maximum fragment distance, unless reduced by DDESB-approved engineering controls.

Further details concerning the MSD calculations for each MRA are provided in Chapter 6 Explosive Siting Plan Table 6-1 Minimum Separation Distances (MSD)

The specified EZ distance will also be enforced during intrusive operations. The purpose of the EZ is to protect the public and other personnel not engaged in intrusive activities from potential blast hazards. The EZs will be marked by signs, caution tape, barriers, or similar materials, and enforced at access points and high traffic areas when necessary. Only essential personnel will be allowed in the EZ during intrusive investigations. It is understood that the EZ will move around the site, as each point is investigated intrusively.

Any reduction of the specified MSD/EZ distance must be approved by the SUXOS, the UXOQC/SO, and the USACE OE Safety Specialist.

3.8.8 MEC Identification

Any suspected or known UXO encountered during excavation will be clearly marked and its position noted on the anomaly dig sheet and other appropriate site maps. The UXO Team Leader (UXO Technician III) will evaluate the item found and report the condition of the item to the UXOQC/SO. No UXO will be moved without positive identification of the item and evaluation of its condition. No UXO identified for destruction will be removed from its location without coordination between the UXOQC/SO and the on site USACE OE Safety Specialist. The inspection procedures are described below.

Potential exposure to chemical warfare material (CWM) on this site is not anticipated. If UXO personnel encounter any UXO that cannot be positively identified as a conventional UXO, the following steps will be taken:

- All work will cease.
- Workers will evacuate upwind.
- The site will be secured.
- The SUXO and/or SSO will notify the SUXOS, Project Manager, and the USACE Los Angeles District Program Manager.
- The USACE Los Angeles Program Manager will notify the Technical Escort Unit and ensure that Department of Army EOD is notified if needed.

3.8.9 MEC Removal

If the excavated anomaly is considered to be UXO, it shall be uncovered sufficiently to obtain a positive identification of the item. If the item is identified as UXO, a determination will subsequently be made as to whether it is acceptable to move. A determination on moving and disposal of UXO will be made by the SUXOS, UXOQC/SO, and the on-site USACE OE Safety Specialist for each occurrence. UXO items that can be moved, will be transported to the explosives storage magazine for storage and destruction at a later date. Any UXO item deemed unacceptable to move will be blown-in-place (BIP) as soon as possible that same day.

BIPs will be conducted in a manner that minimizes impacts to surrounding habitat and wildlife, including direct impacts and disturbance impacts. If the UXO cannot be safely disposed under existing conditions, the MARRS PM, and USACE OE Safety Specialist will be notified. In no case shall the SUXO or UXOQC/SO authorize or undertake destruction of UXO when there is sufficient reason to believe that the disposal action will result in property damage.

All excavations will be back filled to the approximate grade of the surrounding soil. The

excavation site shall be returned as nearly as feasible to an undisturbed condition.

3.8.10 MEC Storage

Whenever possible, the recovered UXO will be moved to the on-site explosives storage magazine awaiting disposal at the end of the project or when the magazine's stated net explosive weight (NEW) capacity (i.e., 10 pounds) is reached, if sooner. The explosives storage magazine will meet the construction and security requirements (e.g., Bureau of Alcohol Tobacco, Firearms and Explosives (BATFE), portable Type II magazine with padlocks and 6-foot chain link fence) identified in Section 6, Explosives Siting Plan.

If an identified UXO item can not be moved (i.e., BIP destruction is required) and conditions prevent demolition during daylight hours, arrangements will be made to provide overnight security. Storage of UXO/MEC (containing HE) is not authorized. MEC which does not contain any HE may be stored in accordance with procedures outlined in Chapter 6 Explosive Siting Plan.

3.8.11 MEC Disposal

All munitions-related material containing explosives will be disposed by detonation. The following sections describe the procedures to be followed during demolition operations in accordance with procedures contained in the Demolition SOP, Appendix J.

3.8.11.1 General Procedures

During disposal of UXO and related material, safety is the primary concern. The most obvious requirements are to protect personnel, the public, and the environment from fire, blast, noise, fragmentation, and toxic releases. In the event demolition of recovered UXO is necessary, the ERRG demolition team leader will contact the local explosives distributor for the delivery of the type and quantity of demolition material per procedures outlined in Chapter 5 Explosive Management Plan. The SUXOS and ERRG demolition team leader will record usage data of demolition material and the nomenclature and quantities of UXO destroyed. The SUXOS will be responsible for the proper use/placement of explosives and for maintaining the required records.

Demolition operations and safety procedures will be conducted according to the standard practices and procedures outlined in the Demolition SOP included in Appendix J. UXO will only be detonated after positive identification. Electrical or non-electrical (Non-El) initiation procedures will be employed as the method of choice for all detonations.

Demolition operations, if required, will take place at the end of the project, for stored items, or at the end of the workday on those items which can not be moved. In the event inclement weather or other conditions prevent the destruction of any UXO during daylight hours, arrangements will be made to provide overnight security. The UXOQC/SO is responsible for determining whether minimum safe conditions to conduct demolition operations are met.

3.8.11.2 MEC

All personnel directly or indirectly engaged in MEC operations are thoroughly trained and capable of recognizing hazardous explosive exposures. All personnel are required to read, become familiar with, and adhere to the requirements contained in this Work Plan and the project Accident Prevention Plan to ensure that all general safety regulations and safe work practices are observed at all times. Absence of a written safety requirement does not indicate that safeguards are not required. All demolition/disposal operations will be conducted in accordance with these procedures and the procedures outlined in Chapter 5 Explosive Management Plan, Chapter 6 Explosive Siting Plan and the Demolition Standard Operating Procedure (SOP) found in Appendix J of this Work Plan.

All UXO subcontractor personnel engaged in MEC demolition activities will follow these procedures. However, situations may warrant additional safety measures, such as fire trucks, medical personnel, and protective clothing. The UXOQC/SO has the overall responsibility to comply with the minimum requirements listed below and has the authority to upgrade as the situation dictates.

Demolition operations will not begin until all non-essential personnel are outside of the MSD established for the ordnance being detonated. MEC that cannot be moved (e.g. fused or hazardous items) must be BIP. The project team will coordinate with the USACE for engineering support whenever it is necessary to blow items in place that are close to structures that could be damaged by the detonation. To the greatest extent possible, all items will be disposed of at the end of the project in the designated demolition area.

On-site disposal shall be under the direct control of a UXO Technician III responsible for all demolition activities within the area. The UXOSO shall be responsible for training all personnel regarding the nature of the materials handled, the hazards involved, and the precautions necessary, and shall be present during all on-site disposal operations. The SUXOS shall ensure that the appropriate local authorities are notified prior to on site demolition. The Department of Toxic Substances Control (DTSC) will be notified prior to any BIP or demolition events.

Prior to initiation of demolition operations, all personnel will be evacuated to a distance outside the MSD of the UXO/MEC being detonated. Prior to priming of demolition charges, all avenues of ingress will be physically blocked by project personnel. Radio communications will be maintained among all concerned parties. Avenues of ingress will not be opened without the express permission of the UXOQC/SO. A constant state of vigilance must be maintained by all personnel to detect any intrusion into the fragmentation zone. An observer will be stationed at a location where there is an unobstructed view of the air and surface approaches to the demolition site. It shall be the responsibility of the observer to notify the SUXOS to suspend firing if any aircraft, vehicle, or individuals are sighted approaching the general demolition site. The UXOSO will assure the area is clear of unauthorized personnel and equipment prior to permitting attachment of the initiation devices to the priming charge.

A minimum of two UXO-qualified personnel, one of whom will be a UXO Tech III, will conduct demolition operations. All demolition operations are performed using standard demolition practices outlined in the Demolition SOP in Appendix J. The preferred method of firing demolition charges is NONEL. Due to the high probability of static buildup and discharge in arid, dusty and windy environment this method provides the greatest safety for the UXO technician and is an effective method for UXO demolition. The SUXOS in conjunction with the on site USACE OE Safety Specialist will decide which firing system is suitable for the specific task to be accomplished. Control of initiation devices will remain with the UXOSO until attachment to the firing circuit.

The following notifications will be made prior to conducting any demolition activity: on-site CESPL OE Safety Specialist, local fire departments, Federal Aviation Administration for air usage, and the County Sheriff's Department. The fire department will be alerted to stand by during demolition operations. In the event of a fire or unplanned explosion, site personnel will be responsible for extinguishing the fire if safe to do so. If unable to do so, they will notify the fire department and evacuate the area.

Engineering controls for blast and fragment mitigation may be required for destruction of specific UXO items. Any engineering controls proposed for use must be approved by CESPL prior to implementation. A copy of the "Use of Sandbags for Mitigation of Fragmentation and Blast Effects due to Intentional Detonation of Munitions" will be available at the site office.

Transportation of MEC and explosives will comply with all federal, state, and local regulations. Permits other than county explosive handling permits are not required under CERCLA for MGRC. Transportation of explosives and MEC on site is discussed in detail in Chapter 5 Explosives Management Plan.

Prevailing weather condition information will be obtained from a reliable source such as the National Weather Service; this data will be logged before each on site detonation. Demolition charges will not be primed or connected for electrical firing during the approach or presence of a thunderstorm. Other weather conditions (high winds, dust storms, temperature inversions, low-altitude clouds, or cloud coverage of more than 50%) may adversely impact planned demolition operations. The SUXOS will consider these conditions when determining whether or not to conduct demolition operations. If weather conditions preclude the disposal, UXO personnel will secure the UXO with sandbags, and cover and properly mark the area until favorable conditions allow the demolition.

Upon completion of disposal operations, the disposal team supervisor and the UXO technician will visually inspect each disposal shot. One of these persons will perform a visual inspection of the disposal site(s). The second person will stand by at a safe distance and be prepared to render assistance in the event of an emergency. Upon completion of this inspection, and providing that there are no residual hazards, the SUXOS will authorize the resumption of site operations.

3.8.11.3 MPPEH, and Munition Debris Inspection and Disposition

The following procedures will be followed during the inspection of MPPEH and munitions debris recovered during the RI.

- UXO Tech I will only tentatively identify a located item as MD or MEC
- UXO Tech II will:
    1. Inspect each item as it is recovered and determine the following:
        - Is the item a UXO or a component of military munitions?
        - Does the item contain explosives hazards or other dangerous filters?
        - Does the item require detonation?
        - Does the item require demilitarization or venting to expose other dangerous fillers?
        - Does the item require draining of engine fluids, illuminating dials and other visible liquid hazardous, toxic or radiological waste (HTRW) materials?
    2. Segregate items requiring demilitarization or venting procedures from those items ready for certification.
    3. Items found to contain explosives hazards or other dangerous fillers will be processed as MEC and disposed of IAW Chapter 6 Explosive Siting Plan.
- UXO Technician III will:
    1. Inspect recovered items to determine if free of explosives hazards or other dangerous fillers and engine fluids, illuminating dials and other visible liquid HTRW materials.
    2. Supervise detonation of items found to contain explosive hazards or other dangerous fillers and venting/demilitarization procedures.
    3. Supervise the consolidation of recovered scrap metal for containerization and sealing.
- UXO Quality Control/Safety Officer (UXOQC/SO) will:
    1. Conduct daily audits of the procedures used by UXO teams and individuals for processing MPPEH or munitions debris.
    2. Perform and document, a minimum 10%, random sampling (by pieces, volume or area) of all scrap metal collected from the various teams to ensure no items with explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials are identified as scrap metal as required for completion of the Requisition and Turn-in Document, DD Form 1348-1A.
    3. Ensure the specific procedures and responsibilities for processing MPPEH and

munitions debris for certification as scrap metal is being followed by their subcontractor ERRG, performed safely, consistent with applicable regulations, and in accordance with this CESPL approved work plan.

4. Will perform random checks of processed MPPEH and munitions debris to ensure that items being identified as scrap are free from any explosive hazards engine fluids, illuminating dials and other visible liquid HTRW materials.

- Senior UXO Supervisor will:

1. Be responsible for ensuring work and Quality Control (QC) Plans specify the procedures and responsibilities for processing MPPEH and munitions debris for the final disposition as scrap metal.
2. Ensure a Requisition and Turn-in Document, DD Form 1348-1A is completed by ERRG for all scrap metal to be transferred for final disposition.
3. Perform random checks to satisfy that the MPPEH or munitions debris is free from explosive hazards necessary to complete the Form, DD 1348-1A.
4. ERRG is certifying all scrap metal generated from MPPEH or munitions debris as free of explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials.
5. ERRG is ensuring that these inspected materials are secured in a closed, labeled, and sealed container and documented as follows:

    - The container will be closed and clearly labeled on the outside with the following information: The first container will be labeled with a unique identification that will start with USACE/MGRC/ERRG/0001/Seal's unique identification and continue sequentially.
    - The container will be closed in such a manner that a seal must be broken in order to open the container. A seal will bear the same unique identification number as the container or the container will be clearly marked with the seal's identification if different from the container.
    - A documented description of the container will be provided by ERRG with the following information for each container; contents, weight of container; location where munitions debris scrap was obtained; name of contractor, names of certifying and verifying individuals; unique container identification; and seal identification, if required. MARRS will also provide these documents in the RI/FS report.

3.8.11.4 Munitions Debris Certification and Verification

MARRS subcontractor, ERRG, will ensure that scrap metal generated from the RI is properly inspected in accordance with the procedures above. Only qualified UXO personnel will perform these inspections. The SUXOS will certify, and the UXOQC/SO will verify, that the scrap metal

is free of explosive hazards.

DD form 1348-1A will be used as certification/verification documentation. All DD 1348-1A forms must clearly show the typed or printed names of the contractor's SUXOS and the UXOQC/SO, organization, signature, and contractor's home office and field office phone number(s) of the persons certifying and verifying the scrap metal.

- Local directives and agreements may supplement these procedures. Coordination with the local concerns will identify any desired or requested supplementation to these procedures.
- In addition to the data elements required and any locally agreed to directives, the DD 1348-1A must clearly indicate the following for scrap metal:
    1. Basic material content (type of metal; e.g., steel or mixed)
    2. Estimated weight
    3. Unique identification of each of the containers and seals stated as being turned over.
    4. Location where munitions debris was obtained
    5. Seal identification, if different from the unique identification of the sealed container.
- The following certification/verification will be entered on each DD 1348-1A for turn over of scrap and will be signed by the SUXOS and the UXOQC/SO.

"This certifies and verifies that the ammunition, explosives, and dangerous articles (AEDA) residue, Range Residue, and/or Explosive Contaminated Property listed has been 100 percent properly inspected and, to the best of our knowledge and belief, are free of explosive hazards."

3.8.11.5 Maintaining the Chain of Custody and Final Disposition

MARRS subcontractor, ERRG, in coordination with the CESPL, will arrange for maintaining the chain of custody and final disposition of the certified and verified materials. The certified and verified material will only be released to an organization that will:

- Upon receiving the unopened labeled containers each with its unique identified and unbroken seal ensuring a continued chained of custody, and after reviewing and concurring with all the provided supporting documentation, sign for having received and agreeing with the provided documentation that the sealed containers contained no explosive hazards when received. This will be signed on company letterhead and stating that the contents of these sealed containers will not be sold, traded or otherwise given to another party until the contents have been smelted and are only identifiable by their basic content.
- Send notification and supporting documentation to MARRS documenting the seal

containers have been smelted and are now only identifiable by their basic content.

- This document will be incorporated by MARRS into the final report as documentation for supporting the final disposition of this scrap metal.

3.8.12 Disposal Alternatives

Due to the nature of use of MGRC as a air-to-ground gunnery range, munitions items located will generally have been fuzed and fired and would be unsafe to move, or if not fired or fuzed, unsafe to move more than once to safely dispose of the munitions in an area that will minimize impact to the site and residents. However, any MEC that does not contain HE and has been determined it is acceptable to move may be transported and stored in a magazine for later disposal by detonation.

3.9 INVESTIGATIVE DERIVED WASTE

The Investigative Derived Waste Plan will be used to detail requirements for handling and disposing of Investigative-Derived Wastes (IDW). A draft letter report will be prepared for the Contracting Officer recommending the appropriate disposal actions and treatment for any IDW generated by this project. Regulatory acceptance of this IDW Plan will be obtained prior to field mobilization.

Hazardous wastes other than RCWM will be disposed of IAW applicable regulations. This may include disposal in a Class II Hazardous Waste Facility. If RCWM is discovered during the project, it will be evaluated and removed by the U.S. Army Technical Escort Unit (TEU).

All IDW will be packaged in accordance with state and Federal laws and regulations. Packaging will ensure segregation of materiel (if necessary) for transportation and ultimate disposal of the IDW. IDW will be disposed by a facility that operates as a Treatment, Storage, and Disposal Facility (TSDF) under Resource Conservation and Recovery Act (RCRA) regulations.

The personnel and equipment necessary to package, label, manifest, transport, and dispose the IDW will be provided by MARRS, as necessary. CESPL will designate the point of contact for signature of the hazardous waste manifest.

All licenses and permits required to comply with applicable Federal, state, and local laws, codes, and regulations will be obtained prior to collections and containerization of IDW. All work will be accomplished in strict accordance with such licenses and permits.

All methods used to ship or transport IDW will be in accordance with Department of Transportation (DOT) Hazardous Material Regulation 49 CFR 100-199. All required hazardous waste manifests will be prepared by an appropriately trained and certified shipping agent or specialist. The manifests will include a correct, complete, and legible description of all wastes to be shipped.